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Zodiac Calendars in the Dead Sea Scrolls and Their Reception

Ancient Astronomy and Astrology in Early Judaism

Helen R. Jacobus

BRILL

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For my family, with love

$\because$

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the National Library of France (Bibliothèque nationale de France) for permission to reproduce Hebrew zodiac man (BnF MS Hébreu 1181, fol. 263 Zodiacal Man:Mélanges de Médecine). The photo of the Prague Astronomical Clock is available via the open access Creative Commons License 2.0 (CC BY 2.0) http://creativecommons.org/licenses/by/2.0/deed.en. The image of the Prosymna globe dial, in storage at the Nafplio Archaeological Museum, Greece, was taken by the author with permission to access from the director of the museum.

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Abbreviations and Notes

1 Abbreviations

Bibliographic abbreviations in the footnotes are also written in full in the Bibliography under the authors' names. The abbreviations follow the style book, where they exist, in *The SBL Handbook of Style for Ancient Near Eastern, and Early Christian Studies*, edited by Patrick H. Alexander et al., Peabody, MA: Hendrickson, 1999.

1 En.	Ethiopic Book of First Enoch
1Q	Qumran Cave 1
4Q	Qumran Cave 4
A	prefix for tablets in the Oriental Institute, University of Chicago
ABD	*Anchor Bible Dictionary.* Edited by D.N. Freedman. 6 vols. New York, 1992
AC	Astrocalc
ACT	*Astronomical Cuneiform Texts.* O. Neugebauer. 5 vols. New Haven, 1995. Reprint, New York, 1983.
AfO	*Archiv für Orientforschung*
AFOS	*Archiv für Orientforschung Supplement*
AHES	*Archive for the History of the Exact Sciences*
AJA	*American Journal of Archaeology*
ANE	Ancient Near East
ANET	*Ancient Near Eastern Texts Relating to the Old Testament*, Edited by J.B. Pritchard. 3rd ed. Princeton, 1969.
ANYAS	*Annals of the New York Academy of Sciences*
AO	prefix for tablets listed in *Der Alte Orient*
APOT	*The Apocrypha and Pseudepigrapha of the Old Testament*
APS	American Philosophical Society
AS	*Assyriological Studies*
ASOR	American Schools of Oriental Research
B.C.E.	Before the Common Era
BE	*The Books of Enoch: Aramaic Fragments of Qumrân Cave 4*. Edited by J.T. Milik. Oxford, 1976.
BETL	Bibliotheca ephemeridum theologicarum lovaniesium
BDB	Brown, Driver and Briggs, *A Hebrew and English Lexicon of the Old Testament*
BH	*Babylonian Horoscopes.* Edited by F. Rochberg. Philadelphia, 1998.

BHBD	*Babylonian Horoscopes* Birth Date
BHMP	*Babylonian Horoscopes* Moon's Position
BLT	Babylonian Local Time
BM	prefix for tablets in the British Museum
BnF	prefix for mss. in the Bibliothèque nationale de France
	Book of Luminaries Ethiopic *Book of Enoch*, Chapters 72–82
CAD	*The Assyrian Dictionary of the Oriental Institute of the University of Chicago*
CANE	*Civilizations of the Ancient Near East.* Edited by J. Sasson. 4 vols. New York, 1995.
CBQ	*Catholic Biblical Quarterly*
CCAG	*Catalogus Codicum Astrologorum Graecorum.* Edited by F. Cumont et al. 12 vols. Brussels, 1989–1953
CD	Calendar Date
CM	Cuneiform Monographs
CRB	*Cahiers de la Revue Biblique*
CSCO	Corpus Scriptorum Christianorum Orientalis
DAI	The German Archaeological Institute, Rome
DCH	*Dictionary of Classical Hebrew.* Edited by D. Clines. Sheffield, 1993–
DJD	Discoveries in the Judean Desert (40 vols.)
DMOA	Documenta et Monumenta Orientis Antiqui
DS	'Dodekatemoria scheme'
DSD	*Dead Sea Discoveries*
DSSEL	The Dead Sea Scrolls Electronic Library. CD-ROM. Part of Brill's Dead Sea Scrolls Electronic Reference Library
DSSSE	*Dead Sea Scrolls Study Edition.* Edited by F. Garcia Martinez and E.J.C. Tigchelaar. 2 vols. Leiden, 1997–1998
DSSR	*Dead Sea Scrolls Reader.* Edited by W.D. Parry and E. Tov. 6. vols. Leiden, 2004–2005.
DKDVS	The Royal Danish Academy of Sciences and Letters
EAE	*Enūma Anu Enlil*
EAT	*Egyptian Astronomical Texts.* Edited by O. Neugebauer and R.A. Parker. 3 vols. Providence, RI, 1960, 1964, 1969
EE	*Enūma Eliš*
Gestirn-Darstellungen	*Gestirn-Darstellungen auf Babylonischen Tontafeln.* Edited by E.F. Weidner. Vienna, 1967.
fol.	folio

HALOT	*The Hebrew and Aramaic Lexicon of the Old Testament* . Eds. L. Koehler, W. Baumgartner and J.J. Stamm. 5. Vols. Leiden, 2002.
HAMA	*A History of Ancient Mathematical Astronomy.* Edited by O. Neugebauer. Berlin, 1975
HdO	Handbuch der Orientalistik
Hen.	*Henoch*
HTR	*Harvard Theological Review*
HUCA	*Hebrew Union College Annual*
IAA	Israel Antiquities Authority
IJS	Institute of Jewish Studies, University College London
ISBE	*International Standard Bible Encyclopedia*
JAJ	*Journal of Ancient Judaism*
JAOS	*Journal of the American Oriental Society*
JBL	*Journal of Biblical Literature*
JCS	*Journal of Cuneiform Studies*
JNES	*Journal of Near Eastern Studies*
JPS	Jewish Publication Society
JRS	*Journal of Roman Studies*
JSOT	*Journal for the Study of the Old Testament*
JSOTSup	*Journal for the Study of the Old Testament*: Supplement Series
JSP	*Journal for the Study of the Pseudepigrapha*
JSPSup	*Journal for the Study of the Pseudepigrapha*: Supplement Series
JSS	*Journal of Semitic Studies*
Jub.	Ethiopic *Book of Jubilees*
LBAT	*Late Babylonian Astronomical and Related Texts*
LCL	Loeb Classical Library
LHBOTS	Library of Hebrew Bible/Old Testament Studies
LSTS	Library of Second Temple Studies
MAA	*Mediterranean Journal of Archaeology and Archaeometry*
Ms Opp.	Manuscript from the Oppenheim Collection, Bodleian Library
MP	Moon's Position
NABU	*Nouvelles assyriologiques breves et utilitaires*
NPID	Nearest Previous Intercalation Dates
NRSV	New Revised Standard Version
NYAS	New York Academy of Sciences
OCD	*Oxford Classic*al Dictionary. Edited by S. Hornblower and A. Spawforth. 3rd ed. Oxford, 2003

OGIS	*Orientis graeci inscriptiones selectee*. Edited by W. Dittenberger. 2 vols. Leipzig, 1903–1905
OPSNKF	Occasional Publications of the Samuel Noah Kramer Fund
Or	*Orientalia* (NS) [Nova Series]
OTP	*Old Testament Pseudepigrapha*, ed. Charlesworth
PAAJR	*Proceedings of the American Academy for Jewish Research*
PAM	Palestine Archaeological Museum
PD	Parker and Dubberstein, *Babylonian Chronology 626 B.C.–A.D. 75*
PTSDSSP	Princeton Theological Seminary Dead Sea Scrolls Project
r.	recto
RevQ	*Revue de Qumran*
P. Oxy	The Oxyrhynchus Papyri
PEQ	*Palestine Exploration Quarterly*
SAA	State Archives of Assyria
SE	Seleucid Era
SSB	*Sternkunde und Sterndienst in Babel*. Edited by F.X. Kugler. Münster, 1907–1924
STDJ	Studies on the Texts of the Desert of Judah
SJOT	*Scandinavian Journal of the Old Testament*
SVT	Studia in Veteris Testamenti pseudepigrapha
TAD	*Textbook of Aramaic Documents from Ancient Egypt,* Porten and Yardeni
TAPS	Transactions of the American Philosophical Society
TSAJ	Texte und Studien zum Antiken Judentum
TCL	Textes cunéiformes, Musée du Louvre
TDOT	*Theological Dictionary of the Old Testament*. Edited by J. Botterweck, H. Ringgren and H.-J. Fabry. 11 vols. Grand Rapids, MI, 2003. and Ringgren
UT	Universal Time
v.	verso
VAT	Vorderasiatische Abteilung Tontafel, Vorderasiatisches Museum, Berlin (tablet prefix)
VT	*Vetus Testamentum*
VTSup	Supplements to *Vetus Testamentum*
WDSP	Wadi Daliyeh Samaria Papyri
WMANT	Wissenschaftliche Monographien zum Alten und Neuen Testament
ZA	*Zeitschrift für Assyriologie*
ZAW	*Zeitschrift für die alttestamentliche Wissenschaft*
ZPE	*Zeitschrift für Papyrologie und Epigraphik*

2 Transcription Signs in the Dead Sea Scrolls

The manuscripts studied here are fragmentary and damaged. The following signs indicate how missing words or letters are restored (using *aleph* as a generic letter) and how lacunas are indicated

א̊	possible letter
א̇	probable letter
˄א˄	supralinear insertion
[א]	reconstructed individual letters or words
]א	text broken after letter or word
]א[	text broken before and after letter or word
Vacat	blank space

3 References to Fragments in the Dead Sea Scrolls

All citations follow the system employed in the principal editions of the Dead Sea Scrolls in the DJD series.

Q	Qumran Cave numbers used in titles: 4Q = scroll from Cave 4, 1Q = scroll from Cave 1

In addition to the cave number, the scrolls have full titles and reference numbers, for example, the Aramaic Astronomical Book of Enoch in the Dead Sea Scrolls = *4QAstronomical Enoch*$^{a–d}$ (4Q208–4Q211). The reference numbers, 4Q208, 4Q209, 4Q210, 4Q211 here indicate different manuscripts not different copies of the same text, although in some scrolls the manuscripts are the same. In that case, these are parallel texts, or copies, and the reference numbers are separated by // parallel lines. The title would be the same, although not necessarily the cave number if copies were found in different sites.

The scrolls may consist of several fragment numbers, indicated by Arabic numerals. Some fragments are large enough to contain more than one column of text; these are indicated by lower case roman numerals. Line numbers, counting the lines from the top of the fragment (which may have broken off, but the space has been calculated) are also given in Arabic numerals.

Words on a line in a sizeable fragment are usually indicated by their fragment number, column number and line number (for example, Fragment 2, column iv, line 2). Small fragments containing a few words may not have column numbers, just the fragment and line numbers. In the case of *4QZodiac*

Calendar and Brontologion (4Q318) the column numbers and line numbers only are used. The column numbers have been calculated from the beginning of the scroll which no longer exists. The calculated column numbers are cols. iv (on the second largest fragment) and cols. vii and viii (on the larger fragment containing two columns). No fragment numbers are used.

The digitised Dead Sea Scrolls online at the Leon Levy Dead Sea Scrolls Digital Library (follow the Explore the Archive link http://www.deadseascrolls.org.il/explore-the-archive) does not always follow the fragment numbering used in the principal editions.

Introduction

> . . . Then heaven and earth will praise
> together. Let all stars of twilight praise
>
> *Apostrophe to Judah 4QPs^f* (4Q88) col. x lines. 5–6[1]

> And Joseph said to them, 'What is this deed that you have done? Do you not know that a man such as I surely practises divination?'
>
> GENESIS 44:15[2]

Ancient calendars are a complex and fascinating subject that allows us to gauge how people in the past marked time and how they measured it for different purposes. In addition to being part of the development of scientific thinking, calendars in antiquity also reflected the daily practical, social and political life of their users; some calendars had spiritual, theological and esoteric functions and were designed for eternity. The subject of calendars in antiquity also invites us to consider our own understanding of how ancient people experienced time and cosmology.

Among the scrolls discovered at Qumran there are a bewildering number of calendars and calendrical texts, to date, the largest collection of different calendars in one archive in the ancient Near East and Mediterranean. Their existence in a library of sacred texts is testimony to a highly complex hermeneutical system involving astronomy and mathematics in early Judaism. No instructions were left for our convenience, and in many cases we are still struggling to work out how the different calendars functioned. Few of the dedicated scholars in the field of Qumran calendar scholarship since the early 1950s to the present time and still continuing, concur with the same interpretation for every single one of them: for example, which of them are solar, lunar,

1 P.W. Skehan, "88. (4QPs^f)," in *Qumran Cave 4.11. Psalms to Chronicles* (ed. E. Ulrich et al.; Discoveries in the Judaean Desert [hereafter DJD] 16. Oxford: Clarendon, 2000), 85–106. (My modified translation).

2 My modified translation from *The Holy Bible; Revised Standard Version* (eds. H.G. May and B.M. Metzger; New York: Oxford University Press, 1962), 57.

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luni-solar, ideal, schematic (or both),[3] and what the unknown terminology, where it exists, means. Nor can we say which ones could, or did work in practice, or why they were composed. Nor, importantly for this book, is it always agreed which texts with calendrical features may be classified as calendars, or how they should be categorised and treated as a corpus.

This research primarily investigates an intriguing Aramaic astrological and calendrical scroll from Qumran, *4QZodiac Calendar and Brontologion* (4Q318), that, to date, has been treated separately from most other calendars because of its particular attributes. 4Q318 consists of a schematic lunar zodiac calendar, a 'selenodromion,'[4] a lunar table that states the position of the moon in the zodiac on specific dates, followed by a zodiacal thunder omen text, a 'brontologion,'[5] which gives predictions for the king and the country, according to the place of the moon in the zodiac when thunder occurs.[6] It is the earliest and only known surviving primary source in the ancient world for a composite selenodromion with a brontologion and was instantly recognised by scholars

3 To define my terms with respect to ancient calendars, a solar calendar (in an earth-centred universe) is the measurement of time taken for the sun's orbit to return to approximately the same point in the seasonal cycle: the solar year is approximately 365.24 days, also known as the tropical year. A pure lunar calendar measures time by the moon's orbits: the months; the lunar year of 354 days is about 11¼ days behind the solar year. A luni-solar calendar aligns the lunar year to the solar year, and hence the seasons, by intercalating, that is, by adding a whole number of days to a 354-day year after a certain number of solar years at regular intervals. An ideal calendar is a prototype to which other calendars may be related. It may approximate to astronomical reality, or it may be too far removed to be viable. A schematic calendar is a simple or formulaic calendar, which may also approximate to the cycles of the heavenly bodies. An ideal calendar can also be schematic, that is, formulaic, but it could also be too complicated to be classed as schematic. A simple schematic calendar could be too different from other calendars to be an ideal type.

4 From the Greek, *selene*: moon, and *dromos*: tracks.

5 Greek, *brontos*: thunder; *logion*: utterance or oracle.

6 J.C. Greenfield and M. Sokoloff, "318. 4QZodiology and Brontology ar [ar is an abbreviation for Aramaic]," in S. Pfann, and P. Alexander et al., *Qumran Cave 4.26. Cryptic Texts and Miscellanea, Part 1* (DJD 36, Oxford: Clarendon, 2000), 259, 262–274, pls. 15; A. Yardeni, (Paleography), DJD 36, 259–261, pl. 16; D. Pingree, "Astronomical Aspects,", DJD 36, 270–272, tables 1–3, 273–274. The *editio princeps* of 4Q318 is a slight revision of the preliminary report by Greenfield and Sokoloff with Pingree and Yardeni, "An Astrological Text from Qumran (4Q318) and Reflections on Some Zodiacal Names," *RevQ* 16/ 64 (1995): 507–525. The prefix "4Q" means Qumran cave 4.

A. Lange and U. Mittman-Richert, "Annotated List of the Texts from the Judaean Desert Classified by Content and Genre," in *The Texts from the Judaean Desert: Indices and an Introduction to the Discoveries in the Judaean Desert Series* (eds. E. Tov et al.; DJD 39; Oxford: Clarendon, 2002), 135–136, 143.

as a genre known from Byzantine astrological texts written in Greek. This study shows that it also appears in separate variant forms elsewhere, and again in other forms in Hebrew manuscripts, one of which is published in this book. It is the only known calendar from the Dead Sea Scrolls so closely related to later material in widespread, different cultural contexts.

Two of the six research chapters in this book explore what I claim is a closely related schematic zodiac calendar in the Dead Sea Scrolls, in the Aramaic Book of Enoch fragments. As is well known, the synchronistic calendar of *4QAstronomical Enoch*[a] and *4QAstronomical Enoch*[b] (4Q208–4Q209) did not travel to the west, but was preserved in an abbreviated form in parts of the Astronomical sections of the Ethiopic Book of Enoch (*1 Enoch*). No parts of 4Q318 are attested in Ethiopic.

The month names in the Qumran lunar zodiac calendar of 4Q318 are Aramaic translations of the Babylonian month names which are known from the Bible and the Hebrew calendar in use today, and its days of the month have ordinal numbers. The scroll contains the only extant calendar found at Qumran that solely uses the Babylonian-Aramaic month names and zodiac signs, still used in the Hebrew calendar today, as well as containing the only omen text in the Dead Sea Scrolls. It is also the earliest primary source for variant names of the signs of the zodiac that are attested in the Palestinian synagogue zodiacs in late antiquity in Hebrew and which continued in use.

1 Clarification of the Title of 4Q318

I have suggested a slight adaption of the full title of this scroll, from "318. 4QZodiology and Brontology ar," in the critical edition, DJD 36, to *4QZodiac Calendar and Brontologion* in order to reflect the subject matter and modernise the terminology.[7] This is a minor variation of the heading used by Geza Vermes ("A Zodiacal Calendar with a Brontologion").[8] "Zodiology" in this context refers to a text that gives a prognosis based on a zodiac sign in a calendar;[9] I would like to make it clear that 4Q318 iv, vii–viii 1–6a (hereafter *4QZodiac Calendar*)

7 4Q318 has been given the abbreviated title *4QZodBront ar* in J.A. Fitzmyer, *A Guide to the Dead Sea Scrolls and Related Literature* (Grand Rapids, MI: Eerdmans, 2008), 70.

8 G. Vermes, *The Complete Dead Sea Scrolls in English* (London: Penguin, 1997), 361.

9 B. Böck, "'An Esoteric Babylonian Commentary' Revisited," *JAOS* 120:4 (2004), 617, 618–619 n. 29, cites W. Gundel and H.G. Gundel, *Astrologumena* (SA 6; Wiesbaden: Franz Steiner Verlag, 1966), 269; Erica Reiner, "Early Zodiologia and Related Matters," in *Wisdom, Gods and Literature* (ed. A.R. George and I.L. Finkel; Winona Lake, IN: Eisenbrauns, 2000), 421–427; E. Svenberg, *Lunaria et Zodiologia Latina* (SGLG 16; Göteborg: AUG, 1963), 3–12.

is treated as an astrological calendar in this thesis, hence the name change. I shall refer to each section of *4QZodiac Calendar* and *4QBrontologion* by their titles separately where necessary. When the siglum 4Q318 is used it may cover both units as a composite text, or either to avoid repetition. Some scholars also refer to *4QZodiac Calendar* as the 'selenodromion,' following the Greek term for this genre; however, I shall use the title *4QZodiac Calendar* for this section of the scroll in reference to its context at Qumran, for the sake of clarity.

It is pertinent to note that this entire manuscript is sometimes entitled the 'Brontologion,' based on its thunder-omen component only: 4Q318 viii 6b–9 (*4QBrontologion*) outside the critical editions.[10] This confusion in designations highlights the fact that *4QZodiac Calendar* is a misunderstood text in the Qumran calendrical corpus. It demonstrates the lack of a historical framework for the phenomenon of zodiac calendars in antiquity, and perhaps a want of a theoretical background to the attitude of Judean society towards its calendars, the zodiac and astrology 2,000 years ago.

2 A Forgotten Calendar?

Although it has often been unnamed in the title of 4Q318, as noted above, and, therefore, rendered invisible to many scholars, the zodiac calendar component of 4Q318 is recognised as a calendar of some kind by the specialists in the field. However, it has been marginalised in the official corpus of calendars in the Dead Sea Scrolls by virtue of its being excluded from the apparent *editio princeps* on Qumran calendars, that is, volume 21 of DJD, entitled *Calendrical Texts* (hereafter DJD 21), an omission admitted by the volume's editor, Shemaryahu

10 E.J.C. Tigchelaar and F. García Martínez, "4Q318 (4QBr ar) *4QBrontologion*," in *Dead Sea Scrolls Study Edition* [hereafter DSSSE] (2 vols. Leiden: Brill, 1998) 676–677; M.O. Wise, "Thunder in Gemini: An Aramaic Brontologion," in *Thunder in Gemini And Other Essays on the History, Language and Literature of Second Temple Palestine* (JSPSup 15; Sheffield: Sheffield Academic Press, 1994), 13–50 (14); E.M. Cook, "A Divination Text (Brontologion)," in *The Dead Sea Scrolls: A New Translation* (ed. M. Wise, M. Abegg Jr., and E. Cook; 2nd ed.; New York: HarperCollins, 2005): 387; U. Schattner-Riesner, *Textes Araméens de la Mer Morte* (LCA 5; Brussels: Éditions Safran, 2005), 14, 127.

The Shrine of the Book, Israel Museum, Jerusalem, online. "The Brontologion Scroll (4Q318)." Cited June 11, 2014: http://www.imj.org.il/imagine/collections/viewDataE5.asp?case=Shrine%20of%20the%20Book and ditto the display card in the Shrine of the Book (viewed April 2008).

Talmon.[11] The Editor-in-Chief of DJD 21, Emanuel Tov, in his Foreword, affirms that 4Q318 reflects "a different calendrical system"[12] and that it is published separately, as are the Cryptic A calendars.[13] J.C. VanderKam questioned the exclusion of 4Q318 and the calendars in Cryptic A script from DJD 21.[14] To my knowledge he is the only scholar to have done so. This thesis suggests that *4QZodiac Calendar* has been under-researched as a calendar and, therefore, has not been considered properly. The official editors of 4Q318, J. Greenfield and M. Sokoloff, in the *editio princeps*, DJD 36, described 4Q318 as a "zodiacal calendar" just once (in the first sentence) without any further explanation or comment.[15] David Pingree who wrote the "Astronomical Aspects" section of 4Q318 in just over two sides of a page and one table,[16] described in two paragraphs how the zodiac calendar, which he refers to as a "table" or "scheme" was structured, and nowhere does he state that the "Zodiology" of the title refers to a calendar. He briefly describes it as a simplified lunar table that lists the moon's mean daily velocity of 13; 10, 35° as it orbits the earth, passing through 13 zodiac signs in each synodic month.[17] He states that the mean

11 S. Talmon et al., eds., *Qumran Cave 4.16. Calendrical Texts* (DJD 21; Oxford: Clarendon, 2001). Talmon acknowledges that 4Q503 and 4Q317 as well as 4Q318 were not included in the volume DJD 21, 36.

12 E. Tov, (Foreword), in Talmon DJD 21, xi; cf. Talmon DJD 21, 36. See also A. Lange, "The Essene Position on Magic and Divination," in *Legal Texts and Legal Issues* (ed. M. Bernstein et al.; STDJ 23; Leiden: Brill, 1997), 391–392.

13 4Q318 is grouped under *Miscellanea, Part 1* in the DJD 36 volume, *Cryptic Texts and Miscellanea, Part 1* (hereafter DJD 36). Contrary to the title *Cryptic Texts*, DJD 36 does not include any Hebrew Cryptic A calendars. Their photographs only are published by S. Pfann in *Qumran Cave 4.28. Miscellanea, Part 2: Cryptic A Calendrical Documents* (DJD 28; Oxford: Clarendon, 2001), pls. 52–62. There is no *editio princeps* for the longest cryptic calendar 4Q317 (*4QcryptA Lunisolar Calendar; formerly 4QcryptA Phases of the Moon*), DJD 28, pls. 52–58; transcriptions and translations of 4Q317 by M. Abegg, "4Q317 (4QcrypicA Lunisolar Calendar)," in *Calendrical and Sapiential Texts* (ed. D.W. Parry and E.Tov; DSSR 4; Leiden: Brill, 2004), 58–72; García Martínez and Tigchelaar, *DSSSE* 2. 672–679. The other calendrical texts in Cryptic A script are: 4Q313[c], in DJD 28, pl. 52, and the small fragments 4Q324[d–i], in DJD 28, pls. 52, 59–62.

14 J.C. VanderKam. Review of Talmon DJD 21, in *DSD* 10.3 (2003), 448–452 (at 448).

15 Greenfield and Sokoloff, "318. 4QZodiology and Brontology ar," DJD 36, 259.

16 D. Pingree, "Astronomical Aspects," section of Greenfield and Sokoloff, "318. 4QZodiology and Brontology ar," DJD 36, 270–272 and Table 2 (wrongly cited as Table 1 in the text but correctly in n. 36).

17 Pingree, "Astronomical Aspects," 270–271.

velocity brings the moon into the 14th sign.[18] No other scholar who has studied the text, including this one, has argued that actual lunar motion is being described in the text. It is a schematic calendar, the astronomy of which is explored in Chapter 1.

The Aramaic Astronomical Book of Enoch fragments, *4QAstronomical Enoch*[a–b] (4Q208–209) is also published under the rubric of *Miscellanea Part 1* in the same *editio princeps*, DJD 36.[19] Only much later were 4Q318 and 4Q208–209 classified as calendrical texts in an annotated list in a critical edition,[20] together with *4QAstronomical Enoch*[c–d] (4Q210– 4Q211).[21] This publication, in 2002, was the first time that the two Aramaic calendars from Qumran had been published in the same list of any kind in a critical edition together as well as with other calendars that had been included or excluded from DJD 21.

3 Was There an Interest in Astrology at Qumran? A Note on *4QZodiacal Physiognomy* (4Q186)

Neither any birth charts nor "primary tables"—ephemerides giving zodiacal degrees and minutes of the heavenly bodies that could be used for horoscopic astrology—were discovered at Qumran, although daily planetary and astronomical tables are well-attested in the ancient Near East and the Hellenistic world.[22] Scholars have suggested that in antiquity zodiac calendars could be used for the purposes of constructing horoscopes. Barbara Böck observed:

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18 Pingree, "Astronomical Aspects," 271 n. 36.

19 E.J.C. Tigchelaar and F. García Martínez, "208–209. 4QAstronomical Enoch[a–b]," DJD 36, 95–171.

20 Lange and Mittman-Richert, subsection 1.4 "Calendrical Texts," in "Annotated List of the Texts," DJD 39, 133–136 (at 135).

21 4Q210 and 4Q211 are published as *4QEnastr*[c] and *4QEnastr*[d] in J.T. Milik, *The Books of Enoch: Aramaic Fragments of Qumran Cave 4* (Oxford: Clarendon, 1976), 284–88, 292–293, pls. 28, 30; 296–297, pl. 29 [hereafter *BE*]; H. Drawnel, *The Aramaic Astronomical Book from Qumran* (Oxford: Oxford University Press, 2011), 209–234, pls. 7 and 8, 272–283, 409–419, publishes 4Q210 and 4Q211 under the sigla of *4QAstronomical Enoch*[c] and *4QAstronomical Enoch*[d].

22 A. Jones, "Astrologers and their Astronomy," in *Oxyrhynchus: A City and Its Texts* (ed. A.K. Bowman et al; G-R M 93; London: EES, 2007), 310–311, 313. (I thank Jacqueline Webb for this reference); A Jones, *Astronomical Papyri from Oxyrhynchus* (*P.Oxy 4133–4300a*) (2 vols.; MAPS 223; Philadelphia: APS, 1999), 40–44; 175–179, no. 4175, p. 177, pl. 7: Almanac-Ephemeris 24 B.C.E, which includes the moon's zodiacal sign and degree; A. Jones, "Babylonian Lunar Theory in Egypt: Two New Texts," in *Under One Sky: Astronomy and*

> In classical times zodiologia apparently became quite popular. Difficult calculation or expensive casting of horoscopes by an expert was superseded by predictions based only on the zodiac, which could easily be made by the layman through the use of the calendar.[23]

By itself, *4QZodiac Calendar* is not an astrological text for the purpose of casting horoscopes but used with *4QBrontologion* it could be regarded as a mantic tool, bearing in mind that the reading of omens in antiquity is still the subject of research by modern scholars.[24] There is one other extant zodiacal manuscript in the Dead Sea Scrolls, *4QZodiacal Physiognomy* (4Q186): the remains of an astrological handbook that ostensibly enables the prognosticator to assess a subject's zodiac sign and their character from their physical, facial and bodily features.[25] Such a text seems to be an alternative to the astronomical or lunar

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Mathematics in the Ancient Near East (ed. J.M. Steele and A. Imhausen; Münster: Ugarit, 2002), 167–174; O. Neugebauer, "A Babylonian Lunar Ephemeris from Roman Egypt," in *A Scientific Humanist: Studies in Memory of Abraham Sachs* (ed. E. Leichty et al.; OPSNKF 9; Philadelphia: The Museum Press, 1988), 301–4; F. Rochberg, "Lunar Data in Babylonian Horoscopes," *Centaurus* 45 (2003): 32–45 n. 2 (44), other horoscopes giving the zodiac sign of the moon in idem, *Babylonian Horoscopes* (Philadelphia: APS, 1998), nos. 9, 10, 12–16, 19–21, 22a, 22b, 23–27; M.P. Nilsson, *Geschichte der griechischen Religion* (Munich: C.H. Beck, 1950), 2.488–490; T. Boiy, *Late Achaemenid and Hellenistic Babylon* (OLA 136; Leuven: Peeters, 2004), 310–311: Papyrus P. Dem. Berlin 9278, a planetary ephemerides for 17 B.C.E. to 11 C.E.

23 Böck, " 'An Esoteric Babylonian Commentary' Revisited," 618–619; Nilsson, *Geschichte der griechischen Religion*, 2.489–450.

24 F. Rochberg, *The Heavenly Writing* (Cambridge: Cambridge University Press), 258–259; D. Lehoux, "The Historicity Question in Mesopotamian Divination," in *Under One Sky*, 209–222.

25 J. Allegro, "186," *Qumrân Cave 4. 1* (*4Q158–4Q186*) (DJD 5; Oxford: Clarendon, 1968), 88–91, pl. 31; M. Popović, *Reading the Human Body* (STDJ 67; Leiden: Brill, 2007), 104–118, the text is dated 30 B.C.E.–20 C.E., ibid., 28. M. Popović, "4Q186. 4QZodiacal Physiognomy. A Full Edition," in *The Mermaid and the Partridge: Essays from the Copenhagen Conference on Revisiting Texts from Cave Four* (ed. G.J. Brooke and Jesper Høgenhaven; STDJ 96; Leiden: Brill, 2011), 221–258; Böck, " 'An Esoteric Babylonian Commentary Revisited,' " 615–620; M. Albani, "Horoscopes in the Qumran Scrolls," in *The Dead Sea Scrolls After Fifty Years: A Comprehensive Assessment* (ed. P.W. Flint and J.C. VanderKam; 2 vols.; Leiden: Brill, 1999), 2.279–330, at 282–289, 301–315, 317–322, 324–328; J.C. VanderKam, "Mantic Wisdom in the Dead Sea Scrolls," *DSD* 43.3 (1997): 340–343; F. Schmidt, " 'Recherche son thème de géniture dans le mystère de ce qui doit être': astrologie and prédestination à Qumran" in *Qoumran et le Judaïsme du Tourant de Notre Ère* (ed. A. Lemaire and S.C. Mimouni; CREJ 40; Leuven: Peeters, 2006), 51–62 (here 51–55); J.C. VanderKam, "Mantic Wisdom in the Dead Sea Scrolls," *DSD* 4.3 (1997): 340–343.

zodiac calendar method of casting a horoscope,[26] not from the birth-date, but from how an individual appeared physically. This system may be connected to the ancient belief of melothesia, that is, that different body parts are 'ruled' by different signs of the zodiac, explored by Popović, in his doctoral thesis.[27] He argues that the text is of sectarian origin and that it was probably used as a guide to control the spiritual quality of new entrants to the community at Qumran.[28]

4QZodiacal Physiognomy is written in Hebrew, the majority of words are written back to front with the letters in reverse order; some letters are paleo-Hebrew, cryptic or Greek. The lines are so arranged that the words are also in inverse order, so that the first word is the last word of the line, so a line reads completely backwards as in 'mirror writing.'

4Q186 contains references to the subject's מולד, *molād* (4Q186 frag 1, col. ii, lines 8; and also frag 2 col i, line 4; and frag 4, line 2),[29] a term translated by Popović as "horoscope,"[30] by which he means representing the nativity that is, a complex interaction of astrological factors, or birth chart, but with a primary interest in the ascendant, the zodiac sign ascending in the east at the time of birth, the Horoscope ὡροσκόπος in Hellenistic astrology.[31]

This interpretation is directly connected to the reference to the "foot of the bull" in 4Q186 fragment 1, column ii, line 9, a phrase that scholars, particularly Albani, deduce as meaning the rising of the early degrees of the zodiac sign of Taurus (see below).

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26 See Section 1.3.1 for a Babylonian 'handbook of astrology' which describes an astronomical method of finding elements of the birth chart with short interpretations of the meanings of the moon in the micro-zodiac and planets in signs.

27 Popović, *Reading the Human Body*. For example, in the contemporaneous astrological poem, Manilius, *Astronomica* 2.453–465 (Goold, LCL).

28 Popović, *Reading the Human Body*, 237–9; J. Ben-Dov agrees for different reasons, arguing that the text's reverse writing is a means of secrecy, "Ideals of Science: The Infrastructure of Scientific Activity in Apocalyptic Literature and in the Yahad," in *Ancient Jewish Sciences and the History of Knowledge in Second Temple Literature* (ed. J. Ben-Dov and S. Sanders). Online. Accessed 4 February 2012, http://dlib.nyu.edu/awdl/isaw/ancient-jewish-sciences/.

29 Allegro, DJD 5, 88–89, plate 31; Popović, *Reading the Human Body*, 29–31; Popović, "A Full Edition," 233, 235.

30 Popović, "A Full Edition," 242–6; Popović, *Reading the Human Body*, 30, 48–51.

31 Ptolemy, *Tetrabiblos* III.2 (Robbins, LCL); for the earliest Greek horoscope with an ascendant, see O. Neugebauer and H.B. Van Hoesen, *Greek Horoscopes* (Philadelphia: American Philosophical Society, 1987), 18–19, discussed in § 4.3: Sundials in Hellenistic Astrology.

4Q186 frag 1, col. ii, line 8[32]

... הואה המולד אש׳ הואה ילוד עליו

... And this is the *molād* under which he was born

4Q186 frag 1, col. ii, line 9a, 9b[33]

ברגל השור עני יהיה וזה בהמתו שור:

'In the foot of the Ox.' He will be poor and this is beast: Taurus

Chapter 4 discusses the calculation of the ascendant in Greco-Roman scientific culture—it is not a recorded factor in Babylonian horoscopes. During the day, the rising sign of 30° cannot be seen because stars are invisible when the sun is in the sky. So during the day the rising sign has to be reckoned, except at sunrise when it would be known from the zodiac calendar (the zodiac sign of the sun would be rising at sunrise with the sun). There is a crude formula that it takes on average 120 minutes for a whole zodiac sign to ascend and there are other calculations; zodiac sundials could determine the ascendant from the position of the sun's shadow on inscribed areas on the dial's surface. It has to be said that pinpointing the feet of the bull by any of these common methods would not be easy.[34]

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32 Online: The Leon Levy Dead Sea Scrolls Digital Library. B-284472. PAM no. M43.438. Taken April 1960. http://www.deadseascrolls.org.il/explore-the-archive/image/B-284472

33 Popović, "A Full Edition," 233, 235 (my translation); *Reading the Human Body*, 29–30, 104–106; Allegro, "4Q186 frg 1, col. ii, line 9," DJD 5, 89; Popović, "Physiognomic Knowledge in Qumran and Babylonia: Form, Interdisciplinarity and Secrecy," *DSD* 13.2 (2006): 164–165; M. Popović, "Reading the Human Body and Writing in Code: Physionomic Divination and Astrology in the Dead Sea Scrolls," in *Flores Florentino* (ed. A. Hilhorst et al.; SJSJ 122; Leiden: Brill, 2007), 280–283; Albani, "Horoscopes in the Qumran Scrolls," 2.286–287.

34 If each sign were divided into nine parts as a form of *dodecatemoria* [see Section 5.3, Manilius, *Astronomica* 2.726–737], instead of twelfths, as Popović suggests (in "The Full Edition," 245, given that the text uses possible division of ninths, Popović, "Full Edition," 226), each ninth part would take just 13$^1/_3$ minutes to rise (120 divided by 9 = 13$^1/_3$) which is rather difficult to determine and physiologically highly detailed. If that were the case, the text would require 108 entries and as many variations of the physiognomic qualities. In fact, Wise suggests that 4Q186 probably was a comprehensive tract and he takes the *dodecatemoria* literally to mean 12 parts (Wise, *A New Translation*, 276– 267). If so, each 2½ degrees of each 30° sign, that is a twelfth, would take 10 minutes to rise and there would be, therefore, some 144 entries in the scroll. Again, there is no indication in 4Q186 of how such fine-tuning as this could be reckoned in a non-mathematical text, nor is there any evidence that there could be 108 or 144 physiognomic variations, unless the text were intended as a rough guide with which the diviner could skilfully estimate the zodiac

Allegro translated 4Q186 1 ii 8b as: "And this is his time of birth on which he is brought forth."[35] The "time of birth," determines the degree of the ascendant, the literal meaning of 'horoscope,'[36] and would be in keeping with the etymology of the word מולד and its placing in the text.[37] Wise translates מולד as "birth sign,"[38] which is a reasonable deduction in the context of the whole entry, and the most straightforward solution but it does not give us any astronomical or astrological information about how the zodiac sign was defined.

Given the complexities of having such a highly detailed system, which it must be noted is unattested, I would propose that each entry in this formulaic text refers to one sign of the zodiac, not to body parts of the native's "beast." I would suggest that the term מולד should refer to the ascendant as a whole zodiac sign, or another meaning of the word should be considered.

The only presumed term for a zodiac sign, המה "beast" or "animal" in the text, is שור Ox, or Taurus, or both.[39] There is a double literary parallel in lines 8 and 9, creating a poetic rhythm: in line 8: the noun from the verb ילד, מולד is paired with ילוד:

> "This is the ascendant(?)מולד under which he was born ילוד."

And in line 9, ברגל השור is paired with וזה בהמתו שור:

> " 'In the feet of the ox,' ברגל השור . . . "And this is his beast, Taurus וזה בהמתו שור."

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degrees of a person's ascendant from 12 basic physical zodiacal types. See pp. 355–357 for the problems of calculating a detailed ascendant in Greco-Roman horoscopes.

35 J. Allegro, "4Q186 (4QHoroscope) frag 2, line 8," DJD 5, 89, pl. 31 (different fragment numbering). It is also possible that the time of birth was pre-ordained in order that the person's destiny should be fulfilled, a theme in the Thanksgiving Hymns, see Section 2.4.2; also M. Morgenstern on 'the birth-times of salvation,' in "The Meaning of בית מולדים in the Qumran Wisdom Texts," *JJS* 51 (2000), 143; Schmidt, " 'Recherche son thème de géniture dans le mystère de ce qui doit être.' Astrologie et prédestination à Qoumrân."

36 Manilius, *Astronomica* 2. 825–830 (Goold, LCL), 146–149. So suggested by Albani, "Horoscopes in the Qumran Scrolls," 293–294, 305–322, and Popović, *Reading the Human Body*, 51,105–6, 194–208; Popović, "A Full Edition," 44–45.

37 מולד is a Hebrew masc, noun, singular, related to the *hophal*, passive participle of the verb ילד (give birth, bear, bring, beget, sv. BDB, 408), cf. so also Schmidt who argues that the meaning refers to conception, translating the *hophal* ילוד as "having been made to be born", that is "engendered," see F. Schmidt, "Ancient Jewish Astrology: An Attempt to Interpret 4QCryptic," in *Biblical Perspectives* (ed. M.E. Stone and E.G. Chazon; STDJ 28; Leiden: Brill, 1998), 194–6 nn. 25, 26.

38 Wise, "A Horoscope Written in Code," in *A New Translation*, 277–278.

39 Popović, "A Full Edition," 243–246.

It is intriguing to consider different options as to what constituted an individual's "beast." According to different scholars, Taurus may denote the position in the zodiac of the sun or moon at the time of birth; or any of these at the time of conception.[40]

In support of the hypothesis that the text may be derived from Babylonian horoscopes and be interested in the moon, the phrase עני יהיה "he will be poor [or humble]" (line 9) may be something other than a possible divinatory statement. It may reflect the prognostications in a late Babylonian astrological handbook TCL 6. No. 14 (A0 6483) which lays down instructions on how to calculate the position of the moon in the 12 sub-divisions (known as the moon's "place" or "region") of a solar zodiac sign.[41] Each region of the moon is marked by a prediction. "He will be poor" is the prediction in obv. line 25 for someone born with the moon in the region of Capricorn, within the whole solar zodiac sign of Aries.[42]

The prognostication of being poor appears in a comparable part-physionomic horoscope text in Judeo-Arabic from the Cairo Genizah: "He who is born in the sign of Scorpio will be acquainted with things and will trust anyone who says anything to him, even a murderer or one who is near death. He will be dark of countenance and brilliant eyed, broad-shouldered and thin-legged. Now whoever is born in the middle [of the sign] will be intelligent and rich. He who is born at its end will be poor and a murderer."[43] Here it is also likely that the solar zodiac sign has been divided into three parts, the beginning, middle and end, far easier to divide up than the ascendant.

It is also possible that the determination of the person's sign was accompanied by a linking aphorism from the Bible, in this instance, Isa 32:20, which contains exactly the same phrase: "foot of the ox," רֶגֶל־שָׁוֹר[44] as 4Q186 1 ii 9a.

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40 Popović, *Reading the Human Body*, 124–125; R. Gordis, "A Document in Code from Qumran—Some Observations," *JSS* 11 (1966): 37–39; Schmidt, " 'Recherche son thème de géniture . . . ' ", 53–54, ref: 4Q186 frag 1, col ii, line 8, 4Q186 frag 2 col i line 4, 4Q186 frag 3, line 1, 4Q186 frag 4, line 2. Presentation of fragments according to Popović, *Reading the Human Body*, 29–31. Cf. Allegro, DJD 5, 88–91, pl. 31. See also Section 4.6.5 for a note on the image of Capricorn on a coin of Augustus: his birthday was on September 23 (sun in Libra), however on that day the moon was in Capricorn, and nine months previously the sun was Capricorn, his conception period. His ascendant is not recorded.

41 A.J. Sachs, "Babylonian Horoscopes," *JCS* 6 (1952), 49–75, text, TCL 6. No. 14 (A0 6483). See Section 1.3.

42 Sachs, "Babylonian Horoscopes," obv. line 25, translation: "The [moon's] place of Capricorn: he will be poor . . . ," 68.

43 R.J.H. Gottheil, "A Further Fragment on Astrology from the Genizah," *JAOS* 49 (1929): 21–302 (at 295).

44 Noted also by Albani, "Horoscopes in the Qumran Scrolls," 2.286 n. 29.

The biblical verse begins with the blessing, אשריכם, "Happy shall you be." This seems to be a form of Judaisation by the use of an abbreviated biblical quotation, a common intertextual practice in the Dead Sea Scrolls.[45] If that is the case, it is likely that each zodiac sign in 4Q186 carried an associated biblical verse that was considered personally lucky, or protected that person in life if recited or written backwards.

The inscribing of particular biblical verses or their extracts in mirror writing, sometimes followed by writing in the correct direction, or mixing up words from biblical verses regarded as apopotraic is an attested late antique Jewish and Samaritan magical practice. Its purpose may have been to confuse demons or to be used as "counter charms" in some contexts.[46]

Further support for a Babylonian derivation of 4Q186, is the notice of the possible " 'granite' (?) stone" אבן צונם (4Q186 fragment 1, column ii line 2)[47]

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45 See, for example in the Thanksgiving Hymns, W.A. Tooman, "Between Imitation and Interpretation: reuse of Scripture and Composition in Hodayot (1QH[a]) 11:6–19," *DSD* 18 (2011): 54–73.

46 For many references on Samaritan inscriptions using biblical verses in reverse on lamps, see J. Naveh. "Lamp inscriptions and Inverted Writing," *Israel Exploration Journal* 38 (1988): 36–43; also citing on reverse writing or reciting words backwards as "counter charms," L. Blau, *Das altjüdische Zauberwesen* (Budapest: Trübner, 1898), 85–86, 147–149; on words written backwards and forwards possibly to confuse demons, M. Gaster, "Samaritan phylacteries and Amulets," *Studies and Texts in Folklore, Medieval Romance, Hebrew Apocrypha and Samaritan Archaeology* (3 vols.; London: Maggs Brothers, 1925–28), 1:448; J. Naveh, "Fragments of an Aramaic Magic Book from Qumran," *IEJ* 48 (1998): 252–261 (253–254). See C. Müller-Kessler, "The use of Biblical Quotations in Jewish Aramaic Incantation Bowls," in *Studies on Magic and Divination in the Biblical World* (ed. H.R. Jacobus, A-K Gudme and P. Guillaume; Piscataway, NJ: Gorgias, 2013), 236, 238, 243–245; for references and texts—Deut 29:22 written forwards and repeated in reverse, the exchange of words in Deut 6:4 (The Shema), Ps 91:1, and the use of partial biblical verses in magic bowls—C.N. Marx, "How Biblical Verses became an Enchantment against the Evil Eye," in *Studies on Magic and Divination in the Biblical World*, 211–226. The use of The Shema inscribed on a gold amulet next to a dead child: E. Eshel, H. Eshel and A. Lange, "Hear O Israel in Gold: An Ancient Amulet from Halbturn in Austria," *JAJ* 1 (2010): 43–64 (at 54–55); N. Doneus, "The Roman Child and the Jewish Amulet," *JAJ* 1 (2010): 146–153; K. Davidowicz and A. Lange, "A Jewish Magic Device in Pannonia Superior?" *JAJ* 1 (2010): 233–245; for a useful bibliography, H. Eshel and R. Leiman, "Jewish Amulets Written on Metal Scrolls," *JAJ* 1 (2010): 189–199; an example of magical Greek reverse writing, R. Kotansky, "A Silver Phylactery for Pain," *The J. Paul Getty Museum Journal* 11 (1983):169–178.

47 Abegg, DSSEL, s.v. 4Q186 frag. 1, col ii line 2; D.J.A. Clines, CDCH, s.v צונם., 37, it is unattested elsewhere in the Dead Sea Scrolls, or in the Hebrew Bible; Allegro, DJD 5, 88, 90; Popović, "Full Edition," 233, 235.

which is written unencrypted, in the standard, right to left scribal practice. I agree with Popović's view that 4Q186 is probably magical and that the uncoded right-to-left writing for the stone is significant, perhaps to endow it with efficacy. He suggests reasonably that in the original text of 4Q186 different stones and other elements were probably associated with particular zodiac signs and physiognomic types.[48] Due to the fragmentary state of the manuscript it is not possible to say whether אבן צונם was also written in reverse for effect[49] as is attested in later magical practices.

There is a substantial corpus of late Babylonian texts in which each of the 12 signs of the zodiac, subdivided into the 12 regions are formulaically grouped with specific trees, plants, stones and minerals, some possibly for sympathetic therapeutic-magical purposes. Sometimes specific temple-cities are included in the list as the first connection with the sign.[50] For example, in one text , in the zodiac sign of Virgo (corresponding to the sixth month of Ellul) the following list pertains: in the 'region' of Libra, the city is Nippur, the tree is the willow, the plant is the saffron crocus and the stone is lapis lazuli (the mineral is absent). The 'region' of Capricorn is assigned the pomegrante tree, the mineral is vitriol[51] and the stone is white coral(?) (the city and plant are not listed).[52]

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48 Popović, *Reading the Human Body*, 52–3; "Full Edition," 235.

49 See digital image, cited above, or DJD 5, plate 31, 4Q186 frag 1 (middle fragment on plate), line 2.

50 The micro-zodiac is explored in Section 1.3 with regards to the moon, without the details of the cities, wood, plants, stones and minerals assigned to each sign within the zodiacal sub-divisions. For a summary of BM 76483 which has the stone-plant-wood formula with the zodiac signs see N.P. Heessel, "Stein-Pflanze-Holz: Ein neuer Text zur 'medizinischen Astrologie,' " *Orientalia NS* 1 v. 74 (2005): 1–22, see p. 14 for source texts to medicine and the zodiac tablets, and stone-plant-tree formulae and medicine; N.P. Heessel, "Astrological Medicine in Babylonia," in *Astrology and Medicine, East and West* (ed. A. Akasoy, C. Burnett and R. Yoeli-Tlalim; Florence: Sismel, 2008), 1–16 (at 9–16). See also M.J. Geller, *Look to the Stars: Babylonian Medicine, Magic, Astrology and Melothesia* (Berlin: Max Planck Institute for the History of Science, 2010). Online: http://www.mpiwg-berlin.mpg.de/Preprints/P401.PDF BM 56606 rev. col. i (p. 80 of 94).Other zodiac texts with assigned trees, plants, cities, stones and minerals are in E. Weidner, *Gestirn-Darstellungen auf babylonischen Tontafeln* (ÖADW 254:2; Vienna: Böhlau, 1967). The zodiacal stone-plant-tree system is also mentioned in the same text as the micro-zodiac, TCL 6 No. 14 (AO 6483) obv. line 6, Sachs, "Babylonian Horoscopes," 67, see Section 1.3.1.

51 For a summary of references to vitriol in antiquity, see V. Karpenko and J.A. Norris, "Vitriol in the History of Chemistry," *Chemické Listy* 96 (2002): 997–1005 (at 998).

52 E. Weidner, tablet VAT 7847+AO 6448, rev. lines 2, 4, *Gestirn-Darstellungen*, 30.

Some of the stones in the corpus could possibly be worn as jewellery, or kept as zodiacal seals,[53] or carried, to protect the wearer.

The lists of cities, plants, trees, minerals and stones in the astrological Babylonian tablets echo the list associated with the Essenes' interest in "the works of the ancients," in particular, "those for the benefit of soul and body; thus with these they search out roots, remedies and properties of stones for the treatment of diseases." (*J.W.* 2:136)[54] None of the fragments of 4Q186 mentions any plants or minerals, and no special stones are known to have been unearthed at Qumran. On the other hand, a carnelian intaglio (engraving in the surface of the gemstone) of the zodiac sign of the scorpion was excavated from The Burnt House in Jerusalem (*terminus ad quem* 70 C.E.); the building is thought to have been inhabited by a priestly family.[55] The carnelian zodiacal seal impression and its origins intimates that there was an interest amongst Jews and possibly a belief in a connection between zodiac signs and gemstones in wider Second Temple circles.

Finally, an interesting possibility is that *4QZodiacal Physionomy* is an angelic book; Josephus states that the Essenes preserved the books belonging to their sect and the names of angels.[56] In the Ethiopic *Book of Enoch*, the booklet describing the names of angels who taught their secrets to humankind, and their skills, the 'Book of Watchers,') (*1 En.* 8:1–3) is extant in fragments in the Aramaic Dead Sea Scrolls. It includes, of particular relevance to 4Q186, a list of the names of angels amongst whom were those who taught humans about precious stones, ('Asa'el עסעל, *4QEnoch*^{b} {4Q202} col. ii, lines 26–28), spells, countercharms, magic (Hermoni חרמוני, *4QEnoch*^{b} {4Q202} col. iii, 2–3; *4QEnoch*^{a} {4Q201} col. iv, lines 1–2), and astrology (Kokab'el כוכבאל, *4QEnoch*^{a} (4Q201)

53 R. Wallenfels, "Zodiacal Signs among the Seal Impressions from Hellenistic Uruk," in *The Tablet and the Scroll: Near Eastern Studies in Honour of William W. Hallo* (ed. M. Cohen, D.C. Snell and D.B. Weisburg; Bethesda, MD: CDL Press, 1993), 281–289.

54 J.E. Taylor. *The Essenes, the Scrolls and the Dead Sea* (Oxford: Oxford University Press, 2013), 306–308, 319–321 (translation, Taylor, op. cit., 306); S.S. Kottek, "Josephus on Poisoning and Magic Cures or, On the Meaning of *Pharmakon*," in *Flavius Josephus: Interpretation and History* (ed. J. Pastor, P. Stern and M. Mor; SJSJ 146; Leiden: Brill, 2011), 247–259.

55 R. Rosenthal-Heginbottom, "Two Jewelry Molds," in *Excavations in the City of David 1978–85* (ed. A. De Groot and D.T. Ariel; *Qedem* 33; Jerusalem: Institute of Archaeology, Hebrew University, 1992), 275–278. R. Rosenthal- Heginbottom, "Jewelry," in *The Eerdmans Dictionary of Early Judaism* (ed. J.J. Collins and D.C. Harlow; Grand Rapids, MI: Eerdmans, 2010), 808–810 (at 809), Figure 2.

56 Josephus, *J.W.* 2.142 (Thackeray, LCL).

col. iv, line 2, *4QEnoch*[b] (4Q202) col. ii, line 3);[57] such kinds of magic are also known from cuneiform texts.[58]

In summary, although non-calendrical, *4QZodiacal Physiognomy* (4Q186) may be a magical book characterised by mirror script, possibly a purported angelic book in which elements of Jewish, Mesopotamian and possible Hellenistic astrology was transmitted. A similar text is witnessed in the Cairo Genizah. I have also suggested that 4Q186 carries an amuletic blessing from the Prophets in the Hebrew Bible.

4 Fate, Time and Divination

The presence of astrological texts among the Qumran scrolls may not be incompatible with what we know about the debate on free will and determinism amongst Judean groups from Classical sources. As well as an interest in semi-precious stones and named angels described by Josephus, noted above, the Essenes believed in predetermination and fate, also according to Josephus.[59] He states that the Essenes foretold future events and that their prophecies were rarely incorrect.[60] To emphasise the point, the only Essenes mentioned, by name: Judas, Simon and Menachem[61] (see below) are given stories, all concerning kings, to illustrate Josephus's description of these skills.[62] Using

57 García Martínez and Tigchelaar, *DSSSE* 401–407. See § 2.4.1 for references to the angels of divination in the Aramaic Book of Enoch and for the argument that 4Q318—and possibly the synchronistic calendar of 4Q208–4Q208 in the Aramaic Astronomical Book of Enoch—are also angelic books.

58 For example see Geller, *Look to the Stars.*

59 Josephus, *Ant.* 13.171–172 (Marcus, LCL); L. Grabbe, "Thus Spake the Prophet Josephus . . . The Jewish Historian on Prophets and Prophecy," in *Prophets, Prophecy and Prophetic Texts in Second Temple Judaism* (ed. Michael H. Floyd et al.; LHBOTS; New York: T&T Clark, 2006), 240–247 (at 243); Todd S. Beall, *Josephus's Description of the Essenes Illustrated by the Dead Sea Scrolls* (Cambridge: Cambridge University Press, 2004, repr. 1988), 109–111; R.T. Beckwith, *The Old Testament Canon of the New Testament Church and Its Background in Early Judaism* (London: SPCK, 1985), 362.

60 Josephus, *J.W.* 2.158–159 (Thackeray, LCL).

61 Judas: Josephus, *Ant.* 13.311–313 (Marcus, LCL), *J.W.* 1.78 (Thackeray, LCL); Simon: Josephus, *Ant.* 17.346 (Marcus and Wikgren, LCL), Josephus, *J.W.* 2.113 (Thackeray, LCL); and Menachem: Josephus, *Ant.* 15.373–9 (Marcus and Wikgren, LCL).

62 J.J. Collins observes that the Essenes named by Josephus are all seers, *Beyond the Qumran Community* (Grand Rapids, MI: Eerdmans, 2010), 129 n. 32, 130, 139–140; he suggests that John the Essene, *J.W.* 2.567, 3.11 may not be a member of the movement, 129, so Steve Mason, stating that "Essene" here refers to John's town of origin, Essa, in Steve Mason,

differently framed and structured narrative techniques,[63] Josephus gives dramatic examples of incidents in which these three named Essenes made royal predictions that were realised, respectively, within hours, days and years. In this way, each one of their predictions involved progressively longer specified lengths of time to be fulfilled in symmetrical mathematical proportions. The first two prophecies were explicitly concerned with shorter term negative outcomes (assassination and exile) and the third prophecy, for Herod, was more complex with the seer avoiding revealing what he saw at the end of Herod's reign. The mathematical time-units are each encased within well-defined individual literary units. In the order that they appear in *Jewish Antiquities*, the royal oracles given by three individual Essenes framed by proportional lengths of time, are:

Hours (Judas): in the prediction by Judas the Essene of the assassination of Antigonus, the brother of the Hasmonean king Aristobulus, Judas is introduced as a seer (*J.W.* 1.78) who never erred in his predictions (*Ant.* 13.311–3).[64] Judas had foretold that Antigonus would be killed in a place some 600 *stades* from where he had made his prediction. Then, when at the Temple with his pupils he saw Antigonus walking past alive and well, he became "distraught." Shortly after the fourth hour the murder occurred in another place by the same name. The story, retold in *Ant.* 13.311–3 with slight changes is related within an ironic literary device linking Judas to *J.W.* 2.158–9: the statement that the Essenes foretell things to come, and rarely miss in their predictions. Variations of the narrative of a correct prediction involving confusion may be a popular classical trope related to different kinds of royal oracles to emphasise the diviner's predictive skills and heighten the dramatic tension, or to make stories about predictions interesting.[65]

Flavius Josephus: Judean War, Translation and Commentary, vol. 1B.2 (Leiden: Brill, 2008), 74 n. 686.

63 See, for example, R. Alter, *The Art of Biblical Narrative* (New York: Basic Books, 1981), 86–87, 95–96, 105–106; J.T. Walsh, *Style and Structure in Biblical Hebrew Narrative* (Collegeville, MN: Liturgical Press, 2011), 7–11.

64 Translation in Beall, *Josephus's Description of the Essenes*, 31.

65 Curiously, there is a nineteenth century purported retelling of a similar royal ascension story: a Scottish minister who practised astrology proclaimed James, King VI of Scotland (and James I of England) before the news of the death of Queen Elizabeth I of England could have been known in Scotland. King James disbelieved the minister but the news that Queen Elizabeth I was dead was proved to be true, see R. Wodrow, *Analecta: or Materials for a History of Remarkable Providences, mostly relating to Scotch Ministers and Christians. v. 2* (Edinburgh: Printed for the Maitland Club, 1842), 341–342.

Taylor points out that the prophecy of Judas the Essene took place when he was with his students of the predictive arts, teaching in the Temple.[66] The implications are that prophecy was a skill that was taught and passed on, gatherings of students of divinatory practices took place in public spaces, and that foretelling the future was not proscribed.[67]

Days (Simon): Simon is introduced as "Simon an Essene by group".[68] in a recognisable composited imitation of the biblical dream interpretation narratives of Daniel and Joseph. The story in *War* 2.113 and retold *Ant.* 17.346[69] concerns Simon being brought before the tyrant Archelaus to interpret his dream after the Chaldeans and other diviners had failed in the task. The dream is very similar to Pharoah's interpreted by Joseph (Gen 41:5–32), and according to Gnuse, to Daniel and Nebuchadnezzar in Dan 2.[70] Simon predicts that the rulership of Archelaus is about to end, then five days after the dream, Archelaus was summoned for trial by Caesar, the interpretation fulfilled within days. I would argue, therefore, that in addition to the allusion to Joseph's skills in oneiromancy, the motif is similar to the trajectory of Daniel's interpretation of the writing on the wall intended for Belshazzar, in Dan 5:7–16. Josephus appears to imply that the skills of dream interpretation, exemplified by Joseph and Daniel, a prophet, are continued by the Essenes.[71]

Finally, years (Menachem): Menachem's prediction to Herod[72] imparted when Herod was a child, and prophesied as not more than thirty years, when Herod was on the throne, illustrated the Essenes' foreknowledge of future events, gifted to them by God. This case, according to Josephus, is testimony that the Essenes engaged in inspired prophecy. Beckwith suggests that the

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66 J.E. Taylor, "The Classical Sources on the Essenes and the Scrolls Communities," in *The Oxford Handbook of the Dead Sea Scrolls* (ed. T.H. Lim and J.J. Collins; Oxford: Oxford University Press, 2010), 179.

67 Cf. Deut 18: 10b; Lev: 19:26b; J. Charlesworth, "Jewish Interest in Astrology during the Hellenistic and Roman Period," in *Aufstieg und Niedergang der römischen Welt* II. vol. 20.2 (ed. H. Temporini and W. Haase; Berlin: Walter de Gruyter, 1987), 926–50, here 948–949.

68 Mason, *Judean War*, 73, nn. 685, 686, (*J.W.* 2.113), translation: "Simon, an *Essaeus*, by type (or race, ancestry, tribe) γένυς." Mason notes that Judas the *Essaeus* was introduced as a seer, μάντις, (*J.W.* 1.78); therefore, this description also applied to Simon.

69 See also translation in Beall, *Josephus's Description of the Essenes*, 33.

70 See R.K. Gnuse, *Dreams and Dream Reports in the Writings of Josephus: a traditio-historical analysis* (Leiden: Brill, 1996), 132–3.

71 See L. Jovanović, *The Joseph of Genesis as Hellenistic Scientist* (HBM 48; Sheffield: Sheffield Phoenix, 2013), 83–84, 91–92, 111.

72 Josephus, *Ant.* 15.373–9 (Marcus and Wikgren, LCL), See also translation in Beall, *Josephus's Description of the Essenes*, 31, 33.

Essenes used methods of interpretation from the Bible itself, or by casting horoscopes (birth-charts) to make their predictions: he argues that Judas could have foretold the day of Antigonus's death from his birth chart, but not from a biblical text because the name of the place where he was killed is not in the Bible. Simon used biblical texts (Beckwith mentions Gen 40–41) to interpret the dream of Archelaus, and Menahem could have prophesied Herod's reign and its outcome from Herod's horoscope, as well as from exegetical biblical prophecy.[73]

With reference to 4Q318 as an astrological text, Albani proposes, "such interests [among the Qumran community] may have been of a merely critical nature."[74] Yet the descriptions of the Essenes's mystical skills in *J.W.* 2.136, 142, 159 could imply that 4Q318 and 4Q186 may not have been incongruent in an Essene archive. Furthermore, the chronicle in Josephus' *J.W.* 6.285–300 devotes several passages to natural and supernatural signs as well as a written oracle (*J.W.* 6.310–315) before the destruction of Jerusalem. "Men of learning," λογιοι, interpreted the omens as foreboding ill, in contrast to the laity who looked for a more optimistic explanation (*J.W.* 6.295).[75] Josephus commented that it is not possible for men to avoid fate, even if they foresee it (*J.W.* 6.314),[76] an observation that is in keeping with the "Essene" world-view (*Ant.* 13.172).[77] Josephus does not, however, mention omen interpretation among the Essenes' skills.

To sum up, magical, astrological texts and foretelling the future in omens and from prophecy are connected to a range of biblical and Second Temple literary genres. These interests are reflected in the work of the Essenes, according to Josephus and are described in tightly constructed literary units. Some predictions include metrology and mathematics and specific time-scales. Science and literature are integrated; indeed, the science offers ancient literature a particular kind of structure and layers of meaning.

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73 R.T. Beckwith, "The Significance of the Calendar for Interpreting Essene Chronology and Eschatology," *Revue de Qumran* 10 (1980): 200–202; R.T. Beckwith, *Calendar and Chronology, Jewish and Christian: Biblical, Intertestamental and Patristic Studies* (Leiden: Brill, 1996), 252–253.

74 M. Albani, "Horoscopes in the Qumran Scrolls," 2.282.

75 See Section 2.4 on the 'kosher' version of the Babylonian omens in Josephus.

76 Josephus, *J.W.* 6.285–315 (Thackeray, LCL).

77 Josephus, *Ant.* Books 12–13 (Marcus, LCL). See Collins, *Beyond the Qumran Community*, 141.

5 Some Strands of Thought in Early Jewish Calendar Scholarship

5.1 *Talmon's Theory of Schism*

We shall now turn to some of the calendrical material from Qumran and the various modern scholarly discourses that have dominated the field since the 1950s in order to understand 4Q318 in its context within contemporary scholarship of the Dead Sea Scrolls.

Following the earliest publications of one of the scrolls, the sectarian interpretative commentary on Prophet texts, פשר, *pesher*,[78] on the biblical book of Habakkuk, 1QPesher Habakkuk (1QpHab),[79] Talmon raised the question of a calendar difference between a possible sectarian group and the Temple in Jerusalem.[80] He interpreted a narrative in 1QpHab column xi, lines 2–8 in which the 'Wicked Priest' apparently attacks the 'Teacher of Righteousness' at the Teacher's place of exile, on the day of "their resting" as indicating that the Teacher of Righteousness and the Wicked Priest followed separate calendars. He argued that there was, therefore, a calendrical schism between a sectarian Jewish group and the Jerusalem Temple. Below is the extract from 1QpHab col. xi, lines 2–8, from line 4:

> 4–5. Its prophetic meaning concerns the Wicked Priest who/ pursued the Righteous Teacher in order to make him reel,/ 6.through the vexation of his wrath, at his house of exile אבות גלותו. it was at the time קץ of the festival of the resting of / 7. the Day of Atonement that he manifested to them, in order to make him reel/ 8. and to trip them on the day of fasting, the sabbath of their resting מנוחתם.[81]

The interpretation that 1QpHab col. xi, lines 2–8 "indirectly evidences the implicit dispute between the Qumran community and the Temple of Jerusalem over the calendar"[82] has been one of the cornerstones of this prevailing scholarly hypothesis ever since Talmon's 1951 paper. The discussion centres on the

78 T.H. Lim, *Pesharim* (Sheffield: Sheffield Academic Press, 2002), 44.

79 W.H. Brownlee, "The Habakkuk Commentary" in *The Dead Sea Scrolls of St Mark's Monastery*, vol. 1: *The Isaiah Scroll and the Habakkuk Commentary* (ed. M. Burrows; New Haven, CN: ASOR, 1950), xix–xxi, pls. 55–61.

80 S. Talmon, "Yom HaKippurim in the Habakkuk Scroll," *Biblica* 32 (1951): 549–563, repr. in idem, *The World of Qumran from Within: Collected Studies* (Jerusalem: Magnes; Leiden: Brill, 1989), 186–199.

81 W.H. Brownlee, *The Midrash Pesher of Habakkuk* (Missoula, Montana: Scholars Press, 1979), 179.

82 Lim, 56 (citing Talmon, 1951, 549–63).

grammatical construction of the pericope. The final line in question, "to trip them on the day of fasting, the sabbath of *their* resting" (line 8), the third person plural male pronominal suffix could indicate:

a) The day was the holy day of the Teacher of Righteousness and those "at his house of exile," and not the Wicked Priest's
b) The Wicked Priest was transgressing the holy day in the same calendar (in keeping with his sobriquet)
c) "The sabbath of their resting" implies that it was the day of resting of both the Wicked Priest and the Teacher of Righteousness, but not the pesharist's.

For Brownlee, it was "probably" b), that is, the observance of Yom Kippur by the Teacher who could not fight in self-defence because it would breach the Law, and the deliberate transgression of the Day of Atonement by the Wicked Priest (who, Brownlee implies, followed the same calendar).[83] Brownlee cites a similar case in 1 Macc 2:29–38, according to which a group of righteous Jewish rebels hid in the wilderness and were slaughtered on the Sabbath by the king's army when they were attacked and had refused to defend themselves on the holy day. As a consequence, in 1 Macc 2:29–41 the Hasmonean king Matthias decided that it would be permissible for Jews to act in self-defence on the Sabbath, otherwise the Jewish people could die in this way.[84]

Fraade has also suggested that there could be a thematic connection between 1 Macc 2:29–41 and 1QpHab xi 4–8; however, he favours, a), following Talmon, by interpreting the latter passage to mean that the Wicked Priest was trying to force the Teacher, and hence probably the Qumran community, to use the correct calendar. It was the Teacher's Day of Atonement, and not the Wicked Priest's:

> The purpose of the Wicked Priest's pursuit of the Teacher of Righteousness to "his house of exile" (presumably, the Qumran community) was to "confuse" the latter, that is, to challenge the correctness and legitimacy of his (their) calendar, and thereby, to "cause them to stumble," that is, to

83 Brownlee, *Pesher Habakkuk*, 189.

84 Brownlee, *Pesher Habakkuk*, 189. Note, there are no ordinances for saving a life, animal or human, in the Damascus Document (CD xi 13, 14, 16), or in the Bible, Exod 20:8–11. 1 Macc 2:28 paraphrases Exod 20: 10c; thus, it is highlighting the problem.

> interfere with their observance of the Day of Atonement (and by implication, the other calendrically assigned days).[85]

Stern takes a different view, arguing in favour of b), that the Wicked Priest desecrated both their Day of Atonement in the same calendar. He states that the pronominal suffix in "the Sabbath of their resting" means that it was the Day of Atonement for the Teacher, but that it "does not mean, however, that the Wicked Priest observed and reckoned the day of Atonement on another day" although he considers the idea that perhaps they sighted the first lunar crescent on different days. He further contends:

> Even if the Teacher did reckon a fundamentally different, 364-day calendar, this would still not be the main polemic in this passage . . . We are thus, left, in conclusion, with very little evidence to support the popular perception that the calendar was a polemical issue in Qumran sectarian sources.[86]

Lim interprets 1QpHab col. xi, lines 6–8 as presupposing that the Teacher of Righteousness and the Wicked Priest adhered to separate calendars but he does not suggest that the calendar was the source of conflict.

> The latter [the Wicked Priest] apparently pursued him [the Teacher of Righteousness] on Yom Kippur (*thus indicating a calendrical difference*) [my italics] to his house of exile at Khirbet Qumran (1QpHab xi: 6–8) and later attempted to murder him (4QpPs^{a} {4Q171} 1–10 iv 8).[87]

A similar emphasis, that the calendar itself was not the root of the conflict, is expressed by Wise, Abegg and Cook[88] and also Schiffman who comments:

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85 S.D. Fraade, *Legal Fictions* (SJSJ 147; Leiden: Brill, 2011), 275. (see Chapter Thirteen, "Theory, Practice and Polemic in Ancient Jewish Calendars," 255–283).

86 S. Stern, "Qumran Calendars and Sectarianism" in Lim and Collins, eds., *The Oxford Handbook of the Dead Sea Scrolls*, 245; also idem, *Calendars in Antiquity* (Oxford: Oxford University Press, 2012), 361–375.

87 T.H. Lim, *Holy Scripture in the Qumran Commentaries and Pauline Letters* (Oxford: Clarendon, 1997), 117.

88 M. Wise, M. Abegg and E. Cook, *The Dead Sea Scrolls: A New Translation* (New York: HarperCollins, 2005), 381.

> The seriousness of the attack against the teacher and his followers is magnified by its occurrence on the Day of Atonement. But it is important to point out that it was the sect's Day of Atonement, not that of the rest of the Jewish people. This most important detail indicates the sect's adherence to a different calendar.[89]

Talmon compared this passage with a story in the Talmud that pertained to an authority dispute between a leading rabbi and another as to when the month began, based on their respective sightings of the first lunar crescent. The former coerced the latter to desecrate the day of Yom Kippur according to the latter's reckoning. Talmon's deduction and conclusion that 1QpHab col. xi, lines 2–8 is related to a "lunar-versus-solar controversy,"[90] became the foundation of his theory of calendar-based sectarianism. Talmon concluded that the Wicked Priest "pursued the Teacher to forcibly prevent him and his followers from observing the Day of Atonement . . . according to their particular calendar, which did not coincide with the calendar of the Priest and his party."[91] Elsewhere, he explained the comparison as narratives with completely opposite outcomes:

> While Rabbi Joshua's dispute with Rabban Gamaliel pertained to differences regarding the lunar calendar that both men followed, the clash between the Teacher of Righteousness and the Wicked Priest revolved around the lunar-versus-solar controversy. And whereas Rabbi Joshua . . . acted as ordered, thus preserving the unity of Israel, the fact that the Teacher of Righteousness persevered in his adherence to a nonconformable ephemeris put the final touch on the Qumran community's schismatic dissent from mainstream Judaism.[92]

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89 L.H. Schiffman, *Reclaiming the Dead Sea Scrolls* (Philadelphia: JPS, 1994), 120.

90 S. Talmon, "Calendars and Mishmarot," in *Encyclopedia of the Dead Sea Scrolls* (ed. L.H. Schiffman and J.C. VanderKam; 2 vols.; Oxford: Oxford University Press, 2000), 1.108–117 (at 116); idem, "The Calendar of the Covenanters of the Judean Desert," in *The World of Qumran from Within*, 147–185.

91 S. Talmon, "The Calendar Controvery in Ancient Judaism: The Case of the Renewed Covenant," in *The Provo International Conference on the Dead Sea Scrolls* (ed. D.W. Parry and E. Ulrich; STDJ 30; Leiden: Brill), 388.

92 S. Talmon, "Calendars and Mishmarot," *EDSS* 2: 116; see also Fraade, *Legal Fictions*, 276–281.

In other work, Talmon suggested that 1QpHab xi 2–8 referred to an intercalation dispute between the Wicked Priest and the Teacher of Righteousness.[93] Beckwith suggested that some Second Temple groups may have used calculation rather than a system of lunar observation to reckon the beginning of the month.[94] This could also mean that months in a pre-determined luni-solar calendar could begin on different days to a luni-solar calendar that is based on the sighting of the lunar crescent.

According to Martone, the 364-day calendar of the Qumran calendars of the priestly courses, the *mišmarot*, was an ideal Temple calendar to replace that of the Jerusalem priesthood that the Qumran group had rejected.[95] The main point from our perspective is that Talmon suggested that there was more than one kind of calendar in active use in Judea. In the 1990s these were discussed by Calloway, and comprehensively summarised by Glessmer and by VanderKam.[96] The variety of 364-day calendars is self evident, although their development and relationship to each other is the subject of disagreement,[97] latterly from Ben-Dov who argues for a linear diachronic development of the 364-day calendar schemes from a single tradition that includes the 360-day

93 S. Talmon, "The Calendar of the Covenanters of the Judean Desert," in *The World of Qumran from Within: Collected Studies*, 167.

94 R.T. Beckwith, "The Essene Calendar and the Moon: A Reconsideration," *RevQ* 15.59 (1992): 459.

95 C. Martone, "Some Observations on the New Mishmarot Texts from Qumran," in *The Provo International Conference on the Dead Sea Scrolls*, 445–449.

96 U. Glessmer, "Calendars in the Qumran Scrolls," in *The Dead Sea Scrolls after 50 Years: A Comprehensive Assessment* (ed. P.W. Flint and J.C. VanderKam; 2 vols,; Leiden: Brill, 1999), 2.213–276 and *Calendars in the Dead Sea Scrolls: Measuring Time* (London: Routledge, 1998); P.R. Calloway, "The 364-Day Calendar Traditions at Qumran." in *Qumranica Mogilanensia*, vol. 2, part 1 (Kraków: Enigma, 1993), 19–29.

97 Glessmer states that he believes there was a plurality of 364-day calendar traditions that emanated from a "diversity of geographical and organisational situations," in "Investigation of the Otot-text (4Q319) and Questions about Methodology," in *Methods of Investigation of the Dead Sea Scrolls and the Khirbet Qumran Site* (New York: New York Academy of Sciences, 1994), 432. (Like the essential Talmon theory, he posits a calendrical split between followers of the Seleucid calendar and the 364-day calendar of *Jub*. 6.36 reflected in the Qumran group, who had dissented from the Temple. He adds that some early Christians may also have followed this calendar, see U. Glessmer, "The Otot Texts (4Q319) and the Problem of Intercalations in the Context of the 364-Day Calendar," in *Qumranstudien: Vorträge und Beiträge auf dem Internationalen Treffen der Society of Biblical Literature, Münster, 25–26 July 1993* (ed. H.J. Fabry, A. Lange and H. Lichtenberger; Göttingen: Vandenhoeck and Ruprecht, 1996), 125–164 (at 145).

calendar.[98] This study will demonstrate the 360-day calendar and the 364-day schemes are completely separate entities and that they co-existed as such. It may be argued, as does Stern, that there is no reason to suppose that the Teacher's group and the Wicked Priest's group followed separate calendars *per se*, nor that any alleged calendrical differences, whatever form they took, were the cause of a political rift.

Furthermore, given the motif of 1 Macc 2:32–41, as first pointed out by Brownlee, historical stories of righteous Jews being at a disadvantage in battle due to their identity and status (followed by a finale of success) was a theme in Jewish religious literature in antiquity.[99] The author of *1QPesher Habakkuk* may not have been a member of the Teacher's group as shown by his double use of the third person possessive suffix: "his house of exile," and may have used a separate calendar as indicated by the third person plural, "the Sabbath of their resting." The latter phrase could suggest, c) the pesharist may have observed the Day of Atonement on a different date to both the Teacher of Righteousness and the Wicked Priest. This could be the case if the Teacher and the Wicked Priest were following the same calendar, and the Wicked Priest was desecrating the Day of Atonement in order to attack the Teacher's group when, as a righteous community they could not defend themselves on the holiest of days.

The Aramaic zodiac calendars in the Dead Sea Scrolls analysed in this study constitute a different genre to the 364-day calendars. They have been left outside this very intense, long-running, and at times rather heated discourse although they are part of the Cave 4 collection along with the variety of 364-day calendar texts.

5.2 *Jaubert's Theory*

Talmon's thesis received growing scholarly support after Annie Jaubert published her hypothesis that the Qumran group followed an ancient Jewish calendar of a 364 day year divided into 52 weeks.[100] Shortly after the discovery of the Dead Sea Scrolls, Jaubert proposed that a first century C.E. "calendrier

98 Ben-Dov, *Head of All Years*, 11–12, 245–246.

99 For example in the Book of Esther, 9:1–2, 31.

100 A. Jaubert, "Le calendrier des Jubilés et de la secte de Qumrân. Ses origines bibliques," *VT* 3 (1953): 250–64 (esp 264); idem, "Le calendrier des Jubilés et les jours liturgiques de la semaine," *VT* 7 (1957): 35–61; idem, "La date de la dernière cène," *Revue de histoire des religions* 146 (1954): 140–173; idem, *La date de la cène: calendrier biblique et liturgie chrétienne* (Ebib; Paris: Gabalda, 1957); idem, *The Date of the Last Supper* (trans I. Rafferty; New York: Alba, 1965), 26–27.

essénien,"[101] a 364-day, fixed, "solar" calendar was reflected in the Synoptic Gospels, and the luni-solar calendar of 354 days could be traced in the Gospel of John. This distinction was the basis of her theory to account for the variant chronology of the day of the week of the Last Supper in the New Testament. Her proposed 364-day calendar was founded on her analysis of the priestly redactional layers of the Hebrew Bible, the pseudepigraphal Ethiopic *Book of Jubilees*,[102] and emerging reports on unpublished material in the Dead Sea Scrolls. About 14 copies of *Jubilees* were discovered in five separate caves at Qumran; even though the *Jubilees* is not believed to have been authored within the Qumran sectarian milieu, it was "a literary pillar of the library."[103] The original Hebrew *Book of Jubilees* is estimated to have been written in the second century B.C.E., c.164 B.C.E.–100 B.C.E.[104]

In Jaubert's "solar" calendar, the 364-day schematic year is sub-divided into four, 13-week seasons of 91 days each, an arrangement that makes a fixed, exact 52-week liturgical calendar possible.[105] Each 91-day trimester consists of two months of 30 days, and a third month of 31 days (in Months III, VI, IX and XII). In this reconstruction of her alleged biblical calendar, the Sabbath and the festivals fall on the same day of the week each year in perpetuity. She referred

101 Jaubert, "Le calendrier des Jubilés et de la secte de Qumrân." 264, 257–8.

102 The most widely used translation of the Ethiopic book is J.C. VanderKam, *The Book of Jubilees* (CSCO 510–11; SA 87–88; Leuven: Peeters, 1989), vol. 2. For an historical to contemporary list of translations and scholarship, see the highly useful I. Oliver and V. Bachmann, "The Book of Jubilees: An Annotated Bibliography from the First German Translation of 1850 to the Enoch Seminar of 2007," *Henoch* 31.1 (2009): 123–164, entries relevant to the calendar: 125, 127, 131–136; 138–144, 146, 151, 154, 158–160.

103 C. Hempel, "The Place of the Book of Jubilees at Qumran and Beyond," in *The Dead Sea Scrolls In Their Historical Context* (ed. T.H. Lim et al.; Edinburgh: T&T Clark, 2001), 195.

104 J.C. VanderKam, *The Book of Jubilees* (Sheffield: Sheffield Academic Press, 2001), 17–21; O.S. Wintermute, "Jubilees," in *The Old Testament Pseudepigrapha* (ed. J.H. Charlesworth; New York, 1985), 2.43. The fragments are: 1Q17–18; 2Q19–20; 3Q5; 4Q176 frags 21–23; 4Q216, 4Q218–224; 11Q12, published respectively in DJD 1, DJD 3, DJD 3, DJD 5, DJD 8, DJD 23; see J.C. VanderKam, "Recent Scholarship on the Book of Jubilees," *CBR* (2008): 406; and bibliographic details, J.A. Fitzmyer, *A Guide to the Dead Sea Scrolls abnd Related Literature* (Grand Rapids, MI: Eerdmans, 2008); J. Stökl, "A List of the Extant Hebrew Text of the Book of Jubilees, their Relation to the Hebrew Bible and some Preliminary Comments," *Henoch* 28.1 (2006): 97–124.

105 Acknowledging the discrepancy with the true solar year, she admitted: "As regards the intercalations in this calendar we are reduced to conjecture. The difficulty has not yet been solved," *Last Supper*, 21–22, n. 9.

to it as a "un calendrier sacerdotal ancien"[106] and a "un calendrier Jubilés-Qumrân."[107] By analyzing the calendar of *Jub*. 6:23–38, the dates of recorded events in *Jubilees*, and some scanty information about primary source texts from the Dead Sea Scrolls, Jaubert proposed that the liturgical days when most recorded events took place in the Bible were Wednesday, Friday and Sunday. Moreover, she deduced that the biblical patriarchs did not set out on their journeys on the Sabbath.[108] The Hebrew fragments of the *Jubilees* from Qumran do not include *Jub*. 6:23–38.

Following the work of Barthélémy,[109] Jaubert found that the year began on the fourth day of the week in accordance with the creation of the luminaries (Gen 1:14–19). In particular, she placed significance on the creation of the stars, although she does not enlarge on why they were important to the *Jubilees* calendar, which does not give a calendrical role to the stars:

> The justification for beginning the year on the fourth day of the week (Wednesday) is the fact that *the stars were created in the fourth day* [Jaubert's emphasis]. For it is precisely from the moment when the stars began to regulate the course of time that the days, the months and the cycle of festivals began to run.[110]

This scheme is different to the 354-day luni-solar calendar, which is less suited to a fixed liturgical cycle because it requires regular intercalation. Milik had verified her theory before he had published a summary of the calendars of the priestly courses found in Cave 4 at Qumran.[111] He had informed her that calendars containing the same 364-day system that she proposed, with the names of the priestly families who served at the Temple in Jerusalem (1 Chron 24:7–19), included liturgical days that fell on Wednesday, Friday and Sunday.[112] (Milik

106 Jaubert, "Le calendrier des Jubilés et les jours liturgiques de la semaine," 35.

107 Jaubert, "Le calendrier des Jubilés et de la secte de Qumrân," 257.

108 Jaubert, "Le calendrier des Jubilés et de la secte de Qumrân," 256; eadem, *Last Supper*, 24–27.

109 R.P. Barthélémy, "Notes en marge de publications recéntes sur les manuscrits de Qumrân," *Revue Biblique* 59 (1952): 199–203; Jaubert, "Le calendrier des Jubilés et de la secte de Qumrân," 250–251; Summary in Glessmer, "Calendars in the Qumran Scrolls," 223–224.

110 Jaubert, *Last Supper*, 24.

111 Jaubert, "Le calendrier des Jubilés et les jours liturgiques de la semaine," 60–61.

112 J.T. Milik, "Le travail d' édition des manuscrits du désert de Juda," *Volume du congrès de Strasbourg, 1956* (VTSup 4; Leiden: Brill, 1957), 25; idem, *Ten Years of Discovery in the Wilderness of Judea* (trans. J. Strugnell; London: SCM Press, 1959), 107–113, and Additional Note 5, p. 152.

did not classify *4QZodiac Calendar* as a calendar and focused on the brontologion part of the manuscript.[113]) Later, Yadin also confirmed Jaubert's theory with the discovery of the *Songs of the Sabbath Sacrifice* from Masada, which contained a similar 364-day model.[114]

Jaubert modified her ideas to include new moons and full moons in the 364-day fixed calendar of Qumran, arguing that liturgical feasts were held on the particular phases of the moon, in accordance with the official, luni-solar calendar.[115] She also noted that there was double dating in the so-called Historical Texts in the Dead Sea Scrolls. These are manuscripts that used a calendar with Aramaic-Babylonian month names with an equivalent date from a calendar that had numerical months.[116] She concluded that "*two liturgical calendars*" (her italics) existed in Second Temple Judaism: one Babylonian and lunar, which was "the official calendar" attested in "later rabbinical Judaism," and another, the archaic, Jubilees-Qumran type calendar, found in "isolated circles" and which had undergone a process of development.[117]

J.C. VanderKam revised Jaubert's theory, postulating that Antiochus IV replaced the ancient Israelite, 364-day solar calendar with the 354-day luni-solar calendar.[118] He argues that the Hasmoneans retained the allegedly imposed luni-solar calendar, resulting in a rift with a breakaway, sectarian group, who preserved the old cultic, liturgical 364-day calendar.

Philip R. Davies agrees that the 364-day liturgical calendar was ancient but he disputes VanderKam's hypothesis that it survived until the Hasmonean era when it was displaced and became a catalyst for a breakaway movement.[119]

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113 Milik, *Ten Years of Discovery*, 42.

114 Y. Yadin, "The Excavations of Masada," *Israel Exploration Journal* 15 (1965): 105–108; Jaubert cites Y. Yadin, *Masada* (Jerusalem, 1965) 81, 106–108, in eadem, "The Calendar of Qumran and the Passion Narrative in John," in *John and the Dead Sea Scrolls* (ed. J.H. Charlesworth; New York: Crossroad, 1991), 62–75.

115 Jaubert, *Last Supper*, 51–52.

116 Discussed in Chapter 1: The Babylonian-Aramaic month names. (Jaubert, *Last Supper*: her information about the double-dating in the then unpublished Historical Texts came from a private communication from J.T. Milik, 51 n. 43 {endnote on p. 157}).

117 Jaubert, *Last Supper*, 51–52, also see 141–143; Glessmer argues that as double-dating Aramaic month names and the 364-day calendar is evident in the Historical Texts [notably 4Q332 frag 2, lines 2–3], it is "beyond doubt" that the Babylonian luni-solar calendar and the 364-day calendar "co-existed." *Calendars*, 228 (discussed in Chapter 1).

118 J.C. VanderKam, "2 Maccabees 6, 7A and Calendrical Change in Jerusalem," *JJS* 12 (1981): 52–74.

119 P.R. Davies, "Calendrical Change and Qumran Origins: An Assessment of VanderKam's Theory," *CBQ* 45 (1983): 80–89.

Davies concurs that the 364-day calendar known from Qumran was used by different groups, but he puts the case that there was no evidence that there was a calendar dispute; he also thought that this calendar fell into disuse in the circles that produced the Book of Esther.[120] Baumgarten raised questions about the accuracy of Jaubert's theory and modified her hypothesis, arguing that her proposed calendar was not necessarily biblical.[121] The question of the accuracy of the Jubilees-Qumran calendar in relation to the Bible and ancient Israel was discussed comprehensively in the subsequent decades.[122]

One recurring criticism is that Jaubert had based her theory on the *Jub* 23–38 calendar, but the *Book of Jubilees* does not mention the days of the week.[123] However, Jaubert was very clear that the new material from Qumran suggested that what she thought was an ancient calendar in *Jubilees* had probably been preserved by the Qumran group in the calendars of the priestly courses with the days of the week, as she had described. She distinguished between what she called the Jubilees-Qumran calendar and the calendar of *Jubilees* (*Jub*. 6:38).[124]

Jaubert's theory that a 364-day calendar existed in the Bible is still under scholarly discussion[125] and the debate on the significance of Sunday,

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120 Davies, "Calendrical Change and Qumran Origins," 81–83, 87–88.

121 J.M. Baumgarten, "The Calendar of the Book of Jubilees and the Bible," *Tarbiz* 32 (1962–3): 317–328 [Heb], repr. in idem, *Studies in Qumran Law* (Leiden: Brill, 1977), 101–114. For example, he argued that in the Qumran *mišmarot* the ceremony of the Waving of the Sheaf took place on 26/1, the Sunday that follows the Sabbath after Passover, but in Josh 5:10–11 the Israelites ate unleavened bread on the day after Passover which was understood to refer to 16 Nisan, in *Studies*, pp. 111–2. See also summary by S. Saulnier, *Calendrical Variations in Second Temple Judaism: New Perspectives on the 'Date of the Last Supper' Debate* (SJSJ 159; Leiden: Brill, 2012), 45–49.

122 B.Z. Wacholder and S. Wacholder, "Patterns of Biblical Dates and Qumran's Calendar: The Fallacy of Jaubert's Hypothesis," *HUCA* 66 (1995): 1–40 (esp. 4–6, 28); J.C. VanderKam, "The Origin, Character and Early History of the 364-Day Solar Calendar: A Reassessment of Jaubert's Hypothesis," *CBQ* 41 (1979): 390–411; L. Ravid, "The Book of Jubilees and its Calendar: A Re-Examination," *DSD* 10.3 (2003): 371–394.

123 J.M. Baumgarten, "The Calendar of the Book of Jubilees and the Bible," in *Studies in Qumran Law*, 106–107; L. Ravid, "The Book of Jubilees and Its Calendar: A Reexamination," 376–377, 393; J. Ben-Dov, *Head of All Years*, 16, 60–61.

124 Jaubert, "Le calendrier des Jubilés et de la secte de Qumrân," 257, 264.

125 For example, Jaubert argued that Noah's Calendar (Gen 7:11–8:14) fitted the 364-day Jubilees-Qumran calendar, "Le calendrier des Jubilés et de la secte de Qumrân," 258, 260. Her analysis of the calendar is very close to that of 4QCommentary on Genesis A (4Q252) fragment 1, column i, lines 3b—column ii, line 5, one of most relevant texts for this discourse. G.J. Brooke, "4Q252. 4QCommentary on Genesis A," , DJD 22, 185–207;

Wednesday and Friday in the Bible, proposed by Jaubert, is ongoing. By applying the Jubilees-Qumran calendar to events in the Bible, Beckwith calculates that activities mainly occurred on Wednesdays, Fridays and Sundays, and, also, like Davies, he concludes that this calendar did not apply to the Book of Esther.[126] (The conversation about her theory on the date of the Last Supper is outside the scope of this study).

6 The Neo-Jaubertian Consensus

The modern, flexible consensus generally diverged from Jaubert's mother-thesis on the key point that there were two, *non-conflicting*, calendars in use in Jewish circles. Instead, until more recently, the backbone of the consensus view accepts that there was a calendar schism between "mainstream Judaism" and an Essene, or sectarian group, who copied and preserved an ancient calendar of disputed age in the Dead Sea Scrolls.[127] These rival calendars, as Talmon argued, were both in use during the first centuries B.C.E. by warring groups: the

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J.L. Trafton, "Commentary on Genesis A (4Q252=4QCommGenA=4QPBless," in *The Dead Sea Scrolls: Hebrew, Aramaic, and Greek Texts with English Translations,* vol. 6: *Pesharim, Other Commentaries, and Related Documents* (ed. J.H. Charlesworth et al.; Tübingen: Mohr Siebeck, 2002), 203–219; G.J. Brooke, "The Genre of 4Q252: the Genre of Poetry to Pesher," *DSD* 1 (1994): 160–179 (at 166–7); T.H. Lim, "The Chronology of the Flood Story in a Qumran Text (4Q252)," *JSS* 43 (1992): 288–298; D.K. Falk, *The Parabiblical Texts: Strategies of Extending the Scriptures Among the Dead Sea Scrolls* (LSTT 63; London: T&T Clark, 2007), 129, 138, 141; R.T. Beckwith, "The Significance of the 364-day Calendar for the Old Testament Canon," in *L'église des deux Alliances: Memorial Annie Jaubert* (*1912–1980*) (ed. Basil Lourié et al.; Piscataway, NJ: Gorgias, 2008), 69–81; H.R. Jacobus, "An analysis of Noah's Calendar Traditions in 4QCommentary A (4Q252) and the Septuagint," in *A View from the Bridge: In Honour of Annie Jaubert* (*1912–1980*). Vol. 2 (ed. Basil Lourié et al.; forthcoming).

126 Beckwith, "The Significance of the 364-day Calendar for the Old Testament Canon," 77–78, 79–80; Davies, "Calendrical Change and Qumran Origins," 82–83; Jaubert, *Date of the Last Supper*, 155 n. 30 notes that 14 Adar in Esth 9:15 does not adhere to the 364-day calendar as it is a Sabbath; however, it would if the month was the 13th month, see H.R. Jacobus, "Calendars in the Book of Esther: Purim, Festivals and Cosmology," in *Studies on Magic and Divination in the Biblical World*, 51–75 (at 72).

127 Talmon, DJD 21, 3, states:

> The Covenanters abided by a solar ephemeris of 364 days which probably had its origin in ancient Mesopotamia, and whose essential characteristics, to all intents and purposes, are identical to the principal features of the calendar propagated in the Book of Heavenly Luminaries (*1Enoch* 72–82), and in Jubilees. In contrast, the schedule of the

luni-solar used by the Temple cult in Jerusalem, and a schematic, "solar" 364-day calendar, which was adhered to by a sectarian group. Jaubert's thesis that the calendar of *Jub.* 6.23–38 and the 364-day Qumran calendars of the priestly courses giving the days of the month are closely related is generally accepted, even though Jaubert's insights have been misrepresented, as discussed above.

The conflict model of a wilderness group *versus* the Jerusalem establishment has since been challenged by scholars.[128] Nonetheless, the hypothesis that all the calendrical material fits into a Jubilees-Qumran calendar model has affected scholarly interpretations of calendrical texts to date. This means, for example, that references to החודש רוש are taken to mean "the new month [in the 364 day calendar)" rather than "the new moon."[129]

Jaubert maintained that the new moon was probably celebrated even when it did not coincide with the first month in the fixed calendar.[130] Her thesis failed to find a practical application for the lunar calendar described in the Ethiopic Astronomical Book of Enoch (*1 En.* 72–82) due to the "confusion" of the text, but she held that it "proves that the courses of the moon held considerable importance for the followers of its calendar."[131] This aspect of her work was revised by Milik, who extended her 364-day calendar template to the Aramaic

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sacrificial services in the Jerusalem Temple conformed to the 354-day lunar year of mainstream Judaism.

See also S. Talmon and I. Knohl, "A Calendrical Scroll from a Qumran Cave: *Mišmarot* B[a], 4Q321," in *Pomegranates and Golden Bells* (ed. D.P. Wright et al.; Winona Lake, IN: Eisenbrauns, 1995), 267–301. They concluded that 4Q321, "and others like it, reflect the calendar controversy in which the Covenanters were engulfed with their opponents. It gives expression to their rejection of the moon and the lunar calendar that arises from the exclusive acceptance of the sun's revolution as the only legitimate foundation of calendar reckoning." (301).

128 In addition to Stern and Fraade mentioned above, see the special edition of *Dead Sea Discoveries* 16.3 (2009), for example, Michael A. Knibb, "The Community of the Dead Sea Scrolls: Introduction," 297–308 (he prefers to use the term "The Dead Sea Scrolls Movement"); Alison Schofield, "Between Center and Periphery: The Yaḥad in Context," 330–350.

129 S. Talmon, "A Calendrical Document from Qumran Cave 4 (mišmarot D, 4Q325)," in *Solving Riddles and Untying Knots: Biblical, Epigraphic, and Semitic Studies in Honor of Jonas C. Greenfield* (ed. Z. Zevit et al.; Winona Lake, IN: Eisenbrauns), 339, 339 n. 37, re: 4Q325 1 3, 1 6, 3 2, (DJD 21, Concordance, 257). Also see K. McAleese, "Actualizing Israel Every Month" (Ph.D. diss., Trinity College, Dublin, 2007), 207–249. I thank him for sending it to me.

130 Jaubert, *Last Supper*, 143.

131 Jaubert, *Last Supper*, 141. She focused her attention on the lunar ephemeris of *1 En.* 74, which she correctly observed was "too confused for it to be of much help by itself."

Astronomical Book of Enoch fragments found at Qumran. He also conjectured that Enoch's age in Gen 5:23 had been changed from 364 to 365 in the Persian period,[132] a speculative deduction that Jaubert did not make.

Taking on board Talmon's influential schism-hypothesis, this investigation puts forward an alternative view that different kinds of calendars were in use together. It offers a reassessment of the points made by Calloway and Glessmer, and later by Stern and Fraade that there was a plurality of calendars in Second Temple Judaism. This research suggests that there was a multiplicity of calendars: different groups used more than one calendar simultaneously for different purposes, such as civil, liturgical, literary, theoretical and divinatory, and that the Aramaic zodiac calendars were probably in use by more than one Jewish group.

7 Questions Regarding Some Scholarship on the Dead Sea Scrolls

7.1 *J.T. Rook's Theory*

In 1981 John T. Rook attempted to revive a theory proposed by nineteenth century scholars, Z. Frankel and A. Epstein that a calendar of 364-day calendar of 13 months, each composed of 28 days, is present in *Jubilees* as a second calendar.[133] Rook had argued in favour of a reconsideration of this hypothesis, based partly on his textual reckoning of the chronology of the separate entrances of Adam and Eve to the Garden of Eden in *Jub.* 3:9–12[134] and the eating of forbidden fruit on 17/11 (the 17th day of the second month).[135] Charles had also observed that a 28-day month was used to reckon the 50-day period

132 J.T. Milik, *The Books of Enoch*, 7–8.

133 John T. Rook, "A Twenty-Eight-Day Month Tradition in the Book of Jubilees," *VT* 31. 1 (1981): 83–87; A. Epstein, "Le Livre des Jubilés, Philon et le Midrash Tadsché," *Revue des études juives* 22 (1891): 8–16; Z. Frankel, "Das Buch der Jubiläen," *Monatsschrift für Geschichte und Wissenschaft des Judenthums* 5 (1856): 311–16; 380–400 (esp. 392), cited in J.C. VanderKam, "A Twenty-eight-day Month Tradition in the Book of Jubilees?" *VT* 32 (1982), 506 n. 1; Oliver and Bachmann, "An Annotated List," 140–141, 154.

134 VanderKam, *The Book of Jubilees* (1989), 17–18; VanderKam, *The Book of Jubilees* (2002), 30–31.

135 Rook, "A Twenty-eight-day Month Tradition," 85–86. Rook calculates the 40 days of Adam's impurity (Jub. 3:9) from the 6th day of the first month, as a 28-day month in the 13-month 364 day calendar, to the 17th day of the second month inclusively, which would be from 6/1–17/11 {23 days before the 28th +17 days of the second month=40 days}, thereby arguing that Month 1 had 28 days.

between the Waving of the Sheaf and the Feast of Weeks.[136] More recently, Segal noted that the calendar of *Jub.* 6 cannot fit the sequence of events of *Jub.* 3:8–14, although he explains the discrepancy on exegetical and theological grounds.[137]

Rook's hypothesis was immediately rejected by both J.M. Baumgarten and J.C. VanderKam[138] (The argument against Rook also implicitly applies to Charles). Baumgarten argued against Epstein's conclusion that the date of the Waving of the Sheaf (Lev 23:11) in *Jubilees*—the festival is not, in fact, referred to in *Jubilees*—must have taken place on the 22nd day of the first month (22/I) in a 28-day month in order for the Festival of Weeks (Shavuot) to occur on the 50th day after Passover (Lev 23:15–16) thereby coinciding with 15/III, the date of the Feast of Weeks in *Jubilees*.[139] According to Baumgarten, as

136 R.H. Charles, "The Book of *Jubilees*," in *The Apocrypha and Pseudepigrapha of The Old Testament* (2 vols; Oxford: Clarendon, 1913; repr. 1966), 2: 35; in a long note to *Jub*. 15.1, Charles states: "At the beginning of this note we found that the feast of weeks took place on the Sivan 15. If we count back fifty days (*reckoning the second month at twenty-eight days*) [my emphasis], we arrive at Nisan 22 when the wave-sheaf was offered. Thus *Jubilees* also interpreted the phase 'the morrow after the Sabbath' as meaning the day after the seventh day of unleavened bread, which was a special day of rest."

The Feast of Weeks is noted in Jub. 15:1, 16:13 and 44: 1–5; VanderKam states that only in *Jub*. 44. 1–5 is the date 15/III evident, see VanderKam, *Jubilees* (2001), 80.

137 Segal, *The Book of Jubilees*, 22, 52–56.

138 J.M. Baumgarten, "Some Problems of the *Jubilees* Calendar in Current Research," *VT* 32.4 (1982: 485–489 and VanderKam, "A Twenty-eight-day Month Tradition in the Book of Jubilees?" 504–506; Saulnier follows them, alleging that Rook "does not consider seriously enough the explicit statements in Jubilees expounding the structure of the year." See *Calendrical Variations*, 45 n. 114.

139 The date of Shavuot in *Jubilees* is assumed to be 15/III, as it is stated to be the "middle of the month" in the third month, for example, *Jub.* 15.1. There must be 50 days from the Waving of the Sheaf to the Feast of Weeks (First Fruits), but the ambiguity of Lev 23:11 reflected in the different interpretations of השבת ממחרת (from the day after the Sabbath) by the Pharisees and Sadducees is opaque in *Jubilees*, which does not indicate when the Waving of the Sheaf occurs. In a 28-day month calendar of 13 months, beginning on Sunday 1/I, if the Waving of the Sheaf occurs on Sunday 22/I, there would be 50 days to 15/III. The Pharisees marked Shavuot on 6 Sivan (6 III) by counting seven weeks (49 days) from the day after Passover. They interpreted "Sabbath" to mean the day of Passover, 15 Nisan, hence they counted 49 days from 16 Nisan, the Waving of the Sheaf, in the 354-day calendar, a luni-solar calendar of 29 and 30-day months. (This practice survives in the rabbinical calendar). The authors of the Qumran *mišmarot* celebrated Shavuot on 15 Sivan, counting 49 days from the Sunday after Passover in the fixed 12-month 364-day calendar in which the year always began on Wednesday. The Sadducees counted seven weeks from the Sunday after Passover (exegeting "Sabbath" literally as Saturday). Therefore,

the Sheaf offering corresponded to 26/1 in the Qumran calendars of the priestly rosters[140] the festival must, therefore, also have occurred on the same date in *Jubilees*.[141] In a later article Baumgarten admitted that no date for the Waving of the Sheaf exists in *Jubilees*, although he still assumed that the date must be the same as that in the Qumran sources.[142] VanderKam argued that the 28-day month theory was based on erroneous data;[143] part of his argument, however, was similar to that of Baumgarten's: he contended that the *Jubilees* calendar was one and the same, not only as that at Qumran, but also *1 Enoch* 72–82;

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there was no fixed date of the month for Shavuot since 15 Nisan can occur on any day of the week. For a discussion on the differing exegetical interpretations of the groups, see David Henshke, " 'The Day After the Sabbath' (Lev 23:15): Traces and Origins of an Inter-Sectarian Polemic," *DSD* 15 (2008), 225–247 (226 n. 3, 229–233).

Thus, if Rook, Charles and Epstein were correct, it would mean that another Jewish group celebrated Shavuot (also the Sunday after Passover, which would be on a Sunday), and all the festivals at a completely different time to those who celebrated the Sabbaths and festivals according to the calendar of *Jub.* 6:23–38, and those who used an observation-based or a calculation-based luni-solar calendar (whichever existed in the second century B.C.E.).

140 Baumgarten, "Some Problems," 487. (See 4Q320 4 III 3, 4 IV 8, 4 V 2, 4 VI 7; 4Q321 frags 4, 5 VI 7; 4Q325 1 3, 4Q326 4, in Talmon et al., DJD 21:54–55, 56–57, 57–58, 59; 77–78; 126–127, 135–136).

141 Baumgarten, "Some Problems," 487 states: "He [Epstein] took it as a matter of course that 'les jours de l'Omer ne peuvent pas commencer plus tard que le 21 du premier mois' (p. 11). This supposition, it turns out, is longer valid. The table of mišmarōt sets the day of the Omer offering 'on the first day of Yedaᶜyah which corresponds to 1/26. This is demonstrably based on a calendar in which the months have 30–31 days. Thus, there is no longer any need for the hypothesis of a religious calendar with 13 months of 28 days."

142 J.M. Baumgarten, "The Calendar of the Book of Jubilees and the Temple Scroll," *VT* 37.1 (1987):75, wrote: "The author of Jubilees appears to have avoided the subject [the differing interpretation of the intended date, or day, in Lev 23:11 among Second Temple groups], though his insistence on the 15th of the third month as the date for Pentecost automatically committed him to commencing the Omer count on the Sunday of the week following Passover." Stéphane Saulnier has argued that the author of Jubilees deliberately omitted the Second Passover from his festival roster (although the festival is listed several times in the priestly courses of the Dead Sea Scrolls: 4Q320 4 IV 9, 4Q320 4 V 3, 4Q320 4 V 12), in "Jub 49: 1–14 and the (absent) second Passover: how (and why) to do away with an unwanted festival," *Henoch* 31 (2009): 42–7. (Belated thanks for sending me the article prior to publication). Also S. Saulnier, *Calendrical Variations in Second Temple Judaism: New Perspectives on the 'Date of the Last Supper' Debate* (SJSJ 159; Leiden: Brill 2012), 93–106. This point illustrates that the *Jubilees* festival roster and that of 4Q320 were not identical.

143 VanderKam, "A Twenty-eight-day Month Tradition," 506, n. 1.

therefore, Epstein's counting of the Omer in *Jubilees* from 22/I was incorrect.[144] Both Baumgarten and Vanderkam, essentially, had argued that more than three corpora, the entire *Book of Jubilees, 1 Enoch* 72–82, the *mišmarot* and all 364-day calendars found in Qumran shared the same calendar. Other scholars' theories that there may be another kind of 364-day calendar in *Jubilees*, correct or otherwise, were dismissed on the basis of a circular argument.

8 Some Problems of Ethiopic Manuscripts and Qumran

Due to its complicated redaction history, the Ethiopic Astronomical Book of Enoch (*1 En.* 72–82) (also known as the *Book of Luminaries*) is the subject of intensive scholarly research.[145] The Ethiopic Astronomical Book as whole is not discussed in this investigation; the main focus is on *1 En.* 72 and where some parts of *1 En.* 72–82 overlap with the calendrical material in the Qumran Astronomical Book (4Q208–4Q211).[146]

As illustrated in the questions raised above on whether there was more than one calendar in the *Book of Jubilees* there was often a general assumption in scholarship during the 1980s and 1990s that a 364-day calendar was

144 VanderKam, "A Twenty-eight-day Month Tradition," 506, n. 1: "Epstein's error was to assume that in [the] Jubilees' calendar the Omer-waving ceremony occurred on I/22. For him, since the Festival of Weeks, which Jubilees dates to III/15, was celebrated 50 days after this event, months I and II must have only 28 days each to accommodate these data. It is now known, however, that in the *1 Enoch-Jubilees-Qumran calendar* [emphasis mine] the Omer-waving ceremony took place on I/26 and therefore, months I and II each lasted 30 days (cf., for example, col. XVIII of the Temple Scroll)."

[Note: The Temple Scroll col XVIII, states: "You shall count seven complete Sabbaths from the day of your bringing the sheaf of [wave offering. You shall c]ount until the morrow of the seventh Sabbath. You shall count [fifty] days." (Translation: Vermes, *Complete Dead Sea Scrolls*, 195). The seventh Sabbath from 26/I in 4 x 91 days calendar is 14/III, hence the "morrow," the Festival of First Fruits, is the 15/III].

145 For a summary of the different Greek and Ethiopic manuscripts, see M.A. Knibb, *The Ethiopic Book of Enoch* (Oxford: Oxford University Press, 1978), 1–47; J.C. VanderKam, "The Textual Base for the Ethiopic Translation of *1 Enoch*," in *From Revelation To Canon* (JSJSup 62; Leiden: Brill, 2000), 380–395; O. Neugebauer. "The 'Astronomical' Chapters of the Ethiopic Book of Enoch (72 to 82)," (Copenhagen: Munksgaard, 1981), 3–42; D. Olson, *Enoch: A New Translation* (North Richland Hills, TX: BIBAL, 2004), 21–22; J. Ben-Dov, *Head of All Years*, 73–74; J.C. VanderKam, *1 Enoch 2*, 345–352.

146 Vanderkam lists the similar material for the synchronistic calendar at Qumran and in *1 En.* as follows: 4Q208, 4Q209 frgs. 1–22, 26, 29–41 [?], 4Q210 1 iii 3–9 and *1 En.* 73:4–8, 74:3–10; 78:6–8 (and vv. 10–16; 79: 3–5), *1 Enoch 2*, 352.

presupposed in the Ethiopic Astronomical Book and that it is structurally related to, or structurally the same as, the 52-week 364-day calendar attested in the *mišmarot*, and the *Jub.* 6:23–38 calendar.[147] The statements *1 En.* 72:32e: "…And the year is exactly 364 days" and *1 En* 75:2i "in the 364 positions of the world," that is, making the point that the calendar has 364-days, is not part of the overlapping material from Qumran; neither *1 En.* 72 nor *1 En.* 75 shares content with the Cave 4 texts.

Since there are no Hebrew fragments at Qumran from the *Book of Jubilees* that correspond *Jub.* 6:23–38, and no similar texts to *1 En.* 72 have come to light among the Dead Sea Scrolls it is problematic if the 364-day calendar in *Jub.*23–38 and an unspecified calendar (or calendars) in *1 En.*72–82 are treated as structurally the same. (The year-length of the synchronistic calendar of *Astronomical Enoch*$^{a-b}$ (4Q208–4Q209) is discussed in Chapter 3).

The following is a brief overview of this scholarly position, surveyed here simply because these statements have been have been part of the 'Qumran calendar' petrie dish since 1991, when 4Q318 was first published (Chapter One). They do not consider the possibility that the different calendars should be classified in a more nuanced way.[148] This streamlined approach inadvertently shaped the scholarship on 4Q208–4Q211 by blurring the distinction between the calendars *Jubilees* and *1 Enoch* (and thus unintentionally impacted on 4Q318 by dividing and separating the Aramaic calendar corpus):

> This particular calendar [*Jub.* 6.30–35], the same as *1 Enoch* and which was in force in the Qumran community, is a solar calendar of three hundred and sixty-four days (v.32), fifty-two weeks, of four equal seasons which always begin upon the same day of week—Wednesday.[149]

147 J.T. Milik, *The Books of Enoch*, 7; J.C. VanderKam, "The 364-Day Calendar in Enochic Literature," *SBL Seminar Papers* (1983), 157–165, here 160; J.M. Baumgarten, "Calendars of the Book of Jubilees and the Temple Scroll," *VT* 37.1 (1987): 77 (71–81); R. Elior, *The Three Temples: On the Emergence of Jewish Mysticism* (trans., David Louvish; Oxford: LLJC, 2005), 45–52.

148 The work of H. Drawnel, *The Aramaic Astronomical Book (4Q208–4Q211) from Qumran* (Oxford: Oxford University Press, 2011), is not included in this conversation because he does not think that 4Q208–4Q209 contains a luni-solar calendar but that it is rather a lunar table describing the periods of lunar visibility during the day and night within the lunar month (clarified in a private correspondence). His study is discussed in Chapter Three.

149 F. García Martínez, "The Heavenly Tablets in the Book of Jubilees," in *Studies in the Book of Jubilees* (ed. M. Albani et al.; TSAJ 65; Tubingen: Mohr Siebeck, 1997), 251.

Some scholarship did not distinguish between fragments of Hebrew and Aramaic manuscripts extant at Qumran containing calendrical material, and the related Ethiopic texts, for example:

> We should not be surprised therefore to find evidence that in ancient Israel a solar calendar at one time threatened to rival the lunar. The primary evidence for this solar calendar is not in the Bible but in Jubilees, and in part of 1 Enoch . . .[150]

Furthermore, issues must be raised by the assumption that the *Book of Jubilees* in its entirety can be studied as if the whole of the Ethiopic text (including the calendrical section *Jub.* 6.23–38) has a Hebrew *Vorlage*:

> Today the scholar is still forced to use the Ge'ez version, as it is the only complete text of the book, but s/he can approach it with some confidence that it preserves a solid representation of the second-century [B.C.E.] Hebrew text.[151]

According to Rochberg, literary passages tend to be copied more or less faithfully in canonical cuneiform texts but there is more flexibility and creativity in the handing down of scientific material.[152] Historically, the impression was sometimes given that *1 Enoch* 72–82, about "30 per cent" of which was discovered written in Aramaic, at Qumran, was an Ethiopic version of the original Aramaic text but with some missing sections and abbreviations,[153] as these statements imply:

> This part of the work [4Q208–4Q209 in Aramaic from Qumran] no longer exists in the Ethiopic version.[154]

> This means that the 364-day solar calendar which is first attested in the Enochic Astronomical Book (1 Enoch 72–82) that was probably written in

150 A.R.C. Leaney, *The Rule of Qumran and Its Meaning* (London: SCM Press, 1966), 81.

151 VanderKam, "Recent Scholarship on the Book of Jubilees," 407.

152 F. Rochberg, "Continuity and Change in Omen Literature," *Munuscula Mesopotamia* (Münster: Ugarit), 425.

153 Milik, *The Books of Enoch*, 5; as Knibb explains (1978, 11–13), "the Ethiopic version is much shorter than the Aramaic" and "where a relationship does exist . . . there are substantial differences between the two."

154 Milik, *The Books of Enoch*, 7.

> the third century BCE, continued to play a role of some sort over a period of several centuries."[155]

Finally, an inaccurate view can be conveyed in popular expositions that the Ethiopic calendrical material from *1 Enoch* and *Jubilees* was found at the Qumran:

> Some history lies behind the calendrical material in the scrolls. The Hebrew Bible or Old Testament says little about times and dates, but in Leviticus 23 and Numbers 28–29 it does legislate exactly when many of the festivals were to take place. A more explicit text is the Astronomical Book of Enoch (*1 Enoch* 72–82, written perhaps in the third century BCE), which supplies the details for two calendars: a solar year lasting 364 days and a lunar year with 354 days. Several copies of this book were found in Qumran cave 4. The Book of Jubilees (written in about 160–150 BCE), also well represented at Qumran, defends a 364-day solar calendar. . . .[156]

Elsewhere, Vanderkam has, of course, clarified the fact that some sections of the Aramaic Astronomical Book did not correspond to *1 En.* 72–82:

> There is no choice but to consult the Ethiopic for most of the text because it is the only surviving witness, but the Aramaic fragments point to a different book, a far more expanded one.[157]

This comment is extremely important for the methodology employed in this study. Although the rules of anachronistic logic hold true, it would be absurd to ignore what are probable later textual witnesses to an earlier tradition, providing that the contexts and the possible relationship between all the texts are understood and considered.

VanderKam has now produced a welcome critical apparatus for the *Book of Luminaries, 1 En.* 72–82, that clarifies and examines the minutiae of the overlapping texts. What cannot be discussed fully without speculation, however, is the question of whether *1 En.* 72 ever existed in the Aramaic Astronomical

155 J.C. VanderKam, "Studies on David's Compositions," *Eretz-Israel* 26 (1999): 214.

156 J.C. VanderKam, "Calendars in the Dead Sea Scrolls," in *The Dead Sea Scrolls: Catalogue of the exhibition of scrolls and artefacts from the collections of the Israel Antiquities Authority at the Public Museum of Grand Rapids, Michigan* (ed. Ellen Middlebrook Herron; Grand Rapids, MI: Eerdmans, 2003), 27.

157 VanderKam, "Calendars in the Dead Sea Scrolls," 18.

Book in Cave 4. VanderKam states that it is "possible and quite likely [that it did] . . . since the system of gates described in Chap. 72 is presupposed in the synchronistic calendar [4Q208–4Q209]."[158]

While it is possible that *1 En.* 72:2–31 existed in some form in the Aramaic Astronomical Book because the arrangement of the 'gates' of heaven corresponds in both texts (explored in this study's Chapter 3), it is also possible that it did not. No fragment of *1 En.* 72 has been uncovered among the Greek fragments from Oxyrhynchus of the *Book of Luminaries* either.[159] However, I shall be putting the case that we cannot rule out the possibility that the basic concept of the heavenly gates[160] existed at the same time in Hellenistic science as the Aramaic astronomical Enoch texts were copied, and that archaeological evidence of contemporaneous zodiacal sundials needs to be considered (Chapter 4).

According to the influential Enochic thesis pioneered by Gabriele Boccaccini,[161] the Aramaic books of Enoch in the Dead Sea Scrolls would have been produced, and circulated over time, from the fourth century B.C.E. by a party within Second Temple Judaism. The Qumran community broke away, preserving the earliest literature until the first century B.C.E., but they did not produce new Enoch material.[162] Boccaccini and Sacchi's theory that an ancient Enoch group followed the same calendar as that in *1 En.* 72–82[163] requires an

158 J.C. VanderKam, *1 Enoch 2*, 357; Vanderkam also cites Albani's view that *1 En.* 72 "would likely have contained such a section because the synchronistic system presupposes the arrangement of the sun's course through the gates" (VanderKam, *1 Enoch 2*, 409, n. 1; M. Albani, *Astronomie und Schöpfungsglaube: Untersuchungen zum astronomischen Henochbuch* (WMANT 68; Neukirchen-Vluyn: Neukirchener Verlag, 1994), 51.

159 J.C. VanderKam, *1 Enoch 2*, 345–308, 409; R. Chesnutt, "*Oxyrhynchus Papyrus 2069* and the Compositional history of *1 Enoch*," *JBL* 129 (2010): 485–505.

160 (Also *1 En.* 74:4–8; 75:2, 4, 6; 76; 78:5; 79:3–4).

161 G. Boccaccini, *Beyond the Essene Hypothesis: The Parting of the Ways between Qumran and Enochic Judaism* (Grand Rapids, MI: Eerdmans, 1998).

162 Boccaccini, *Beyond the Essene Hypothesis*, 1–14; 119–160. See also J.J. Collins, "Enoch, the Dead Sea Scrolls, and the Essenes: Groups and Movements in Judaism in the Early Second Century B.C.E.," in *Enoch and Qumran Origins: New Light on a Forgotten Connection* (ed. G. Boccaccini; Grand Rapids, MI: Eerdmans, 2005), 345–350; Wido van Peursen, "Qumran Origins: Some Remarks on the Enochic/ Essene Hypothesis," *RevQ* 20:2 (2001), 241–252; David R. Jackson, *Enochic Judaism: Three Defining Paradigm Exemplars* (LSTS 49; London: T&T Clark, 2004), 214–220; P.S. Alexander, "Enoch and the Beginnings of Jewish Interest in Natural Science," in *The Wisdom Texts from Qumran and the Development of Sapiential Thought* (ed. C. Hempel et al.; BETL 159; Leuven: Peeters, 2002), 223–243.

163 Boccaccini, *Beyond the Essene Hypothesis*, 96, 114, 101; Sacchi, "The Two Calendars of the Book of Astronomy," 128–139; G. Boccaccini, "The Solar Calendars of Daniel and Enoch,"

adaptation to incorporate the Aramaic fragments containing calendrical material found at Qumran.[164]

This study will demonstrate that the Aramaic calendar in *4QAstronomical Enoch*$^{ab-d}$ (4Q208–4Q9, 4Q211) should be considered separately from the Jubilees-Qumran calendar. I will show that *4QAstronomical Enoch*$^{a-b}$ (4Q208–4Q209) is astronomically and arithmetically related to *4QZodiac Calendar and Brontologion* (4Q318), whereas the Jubilees-Qumran calendar is probably not related to 4Q208–4Q209 and 4Q318. It will also be shown, in Chapter 4, that *1 En.* 72 is a late witness to the template for Greco-Roman zodiac sundials, whereas the 364-day Jubilees-Qumran calendar is not connected to them.

There is a scholarly conversation as to whether the *Jub.* 6:23–38 calendar was a "sabbatical calendar" or a septenary structure that was based on a more ancient 364-day calendar that did not highlight the Sabbath day.[165] While that debate is not the focus of this study it may be maintained that the discourse on the liturgical aspects of the 52-week calendar of *Jubilees* has reinforced the lack of discussion on the zodiac calendars, due to the fact that the zodiac is absent from *Jub.* 6:23–38. Unlike the Jubilees-Qumran calendar, 4Q318 and 4Q208–4Q209 do not contain fixed Sabbath and festival days. The tendency towards creating a systematic presentation of different manuscripts and pseudepigraphical books from separate time periods, different cultures and geographical origins in Ethiopic has resulted in the virtual exclusion of 4Q318 from the subject of Qumran calendars (and to a lesser extent, 4Q208–4Q209) because it did not fit into a particular scheme (the 12 month 364-day year).

9 Summary

The early consensus that arose following Talmon's interpretation of 1QpHab col xi, lines 2–8 assigned the luni-solar calendar to the priests in Jerusalem and "mainstream" Judaism, and a schematic, 364-day, "solar" calendar to a sectarian group at Qumran. Based on samples of those scrolls that had been

in *The Book of Daniel* (ed. J.J. Collins and P.W. Flint; SVT 83; 2 vols; Leiden: Brill, 2002), 2: 311–328; J.J. Collins, "How Distinctive was Enochic Judaism?" *Meghillot* 5–6 (2008): 17–34 (at 23–24); Stone, "Enoch, Aramaic Levi and Sectarian Origins," *JSJ* 19.2 (1988): 159–170.

164 Milik, *The Books of Enoch*; Drawnel, "Priestly Education," *RevQ* 22 (2006): 547–574; Drawnel, "Moon Computation," *RevQ* 89 (2007): 3–42; García-Martínez and Tigchelaar, "208–209 4Q Astronomical Enoch^{a-b}," DJD 36, 95–171; O. Neugebauer, "The 'Astronomical' Chapters of the Ethiopic Book of Enoch (72 to 82)," 3–42.

165 This discussion is laid out in Ben-Dov, *Head of All Years*, 52–62.

published and her private correspondence with Milik, Jaubert proposed that there was a diversity of calendars at Qumran. She also saw a role for a lunar, Enochic calendar. Modern scholars revised her thesis and replaced it with a variable dichotomous paradigm based on polarisation (with one postulating a diachronic model instead) accompanied by highly detailed specific hypothetical historical models that she had not advanced.

The revised dichotomous position excluded *4QZodiac Calendar and Brontologion* (4Q318) and the Aramaic Astronomical Book from Qumran, *4QAstronomical Enoch*$^{a-d}$ (4Q208–4Q211) from the context of Qumran calendar scholarship, and the sole diachronic position marginalises 4Q318 only. This study will put the case that the calendars of 4Q318 and the Aramaic Astronomical Book have been artificially separated from the main collection of diverse calendars by current scholarship as well as from each other. For 4Q318, an unusual text in the collection, this has meant an assumption in some quarters that it is so marginal, that it should not even have been at Qumran.[166]

10 Parameters of this Research

This investigation covers the comparative background, history and contemporaneous scientific context of the genre that was the seedbed of the Aramaic zodiac calendars from Qumran. The 'reception' of this genre in different stages and geographical contexts, languages and forms includes studies of individual texts, artefacts and archaeological sites, from Babylonia, the Greco-Roman world, late antique and medieval Byzantine periods in Palestine, to the latest stage of the Byzantine era in Constantinople. I am, thus, using the term 'reception' to cover the flourishing of theoretical ideas contained in *4QZodiac Calendar and Brontologion ar* (4Q318) and the zodiac calendars in *4QAstronomical Enoch*$^{a-d}$ *ar* (4Q208–4Q211) from the past, their present and their future incarnations. Reception of these texts does not suggest that these particular scrolls were directly responsible for the zodiacal calendar tradition thereafter, but that they are textual witnesses to popular thought in the ancient world, and that these ideas survived. It will be shown that the zodiac calendar of 4Q318 is useable with the Babylonian calendar and that it is still useable with the contemporary Hebrew calendar. It will also be argued that

166 "While 4Q318 may indeed be considered extraneous in the Qumran library, as it does not accord with Enochic astronomy…" J. Ben-Dov, in "Discussion," in *Aramaica Qumranica* (ed. K. Berthelot and D. Stökl Ben Ezra; STDJ 94; Leiden: Brill, 2010), 44.

4Q208–4Q209 is a zodiac calendar (also attested in parts of 4Q210 and 4Q211) and that they are part of the same genre.

11 Structure of this Study

I have taken an historical and scientific methodological approach to 4Q318 and the texts that may be related to it. The key aims are as follows:

1. To explicate the relationships of *4QZodiac Calendar* and *4QBrontologion* to each other materially, historically, thematically and technically.
2. To investigate the relationships of *4QZodiac Calendar* and *4QBrontologion* in relation to their separate and combined historical backgrounds outside Qumran.
3. To examine the relationships of *4QZodiac Calendar* and *4QAstronomical Enoch*$^{a-b,d}$ (4Q208, 4Q209, 4Q211) to other scrolls where appropriate.
4. To consider the relationships of *4QZodiac Calendar* and *4QBrontologion* to later material and intellectual developments over time.
5. To reassess the relationship between the Aramaic zodiac calendars of 4Q318 and 4Q208, 4Q209 and 4Q211 within a comparative cultural context.

It is intended that this approach will cast light on the context of 4Q318 within the corpus of Dead Sea Scrolls and in the ancient Near East and Mediterranean cultures.

The discussion about its transmission encompasses not only geographical questions but also time-periods. As shall be explicated in Chapter 1, previous in-depth scholarship and the critical edition originally published in the mid-1990s established that *4QZodiac Calendar* has a Mesopotamian background, but its specifics have been left obscure. This research has now moved forward and should be updated. The chapter also explains how, in my view, 4Q318 works, that it was useable in antiquity, and today. I explore its mathematics and demonstrate that the rabbinical calendar is descended from the same late Babylonian mould.

Focusing on the thunder omen text of 4Q318, *4QBrontologion*, Chapter 2 explores Byzantine Greek brontologia and Mesopotamian omen texts to draw out possible connections with the Qumran brontologion. The study also investigates how *4QZodiac Calendar* may have functioned with *4QBrontologion*. Furthermore, since 4Q318 contains an omen and the zodiac, the question of divination in Second Temple Judaism is intrinsically considered. In a sense,

therefore, this investigation is a social, historical, geographical, scientific and cultural detective story.

Chapter 3 deals with parts of the fragments of the Aramaic Astronomical Book of Enoch from Qumran, *4QAstronomical Enoch*$^{a-b,d}$ (4Q208–4Q209, 4Q211) and the Astronomical section of the Ethiopic Book of Enoc*h* (*1 Enoch* 72–82). I reconsider the consensus view that has dominated scholarship in this field since the 1960s that the zodiac signs are not represented in these texts and put forward another interpretation of the fragments.

Chapter 4 employs the comparative method in an archaeological context by exploring zodiacal Greco-Roman sundials. I show that these scientific instruments are related to the zodiacal cosmology of *1 En.* 72 and that the Ethiopic text helps us to understand these artefacts. It is suggested that there are common Hellenistic Greek origins underlying the zodiacal elements of *4QAstronomical Enoch*$^{a-d}$ (4Q208–4Q211).

Chapter 5 focuses on the zodiac calendar element of 4Q318 in relation to related contemporaneous literary and archaeological material. It compares ancient scientific and literary writing and material culture on the zodiac in the ancient Near East, Mediterranean and Hellenistic Jewish traditions with the zodiacal scheme of *4QZodiac Calendar*.

Finally, Chapter 6 contains a commentary, transliteration, translation and reproduction of a hitherto unpublished fifteenth century Hebrew manuscript from the Bodleian Library, University of Oxford, MS. Opp. 688, fol. 162v. The folio, in a handwritten book, contains a table for the moon's position in the zodiac in a similar scheme to that of *4QZodiac Calendar*. Like 4Q318, this manuscript is coupled with different astrological traditions, phlebotomy and melothesia that can be used with a lunar zodiac calendar.

To summarise the whole, this research examines whether *4QZodiac Calendar* belongs to a tradition of finding the zodiacal position of the moon in antiquity, based on the day and month.[167] The study will throw light on the complex nature of 4Q318, which some scholars have isolated from the Dead Sea Scroll corpus in general.[168] I show that *4QZodiac Calendar* can be used to enhance our understanding of the Astronomical Book in the Dead Sea Scrolls,

167 Cf. M. Albani, "Horoscopes in the Qumran Scrolls," 2.322–323. In fact, this study picks up the questions that Albani raised here; however, he appears to contradict these insights at p. 300.

168 D. Dimant, "The Qumran Aramaic Texts and the Qumran community," in *Flores Florentino*, 200–201; D. Dimant, "Themes and Genres in the Aramaic Texts from Qumran," in *Aramaica Qumranica*, 42.

4Q208–4Q209, 4Q211, and it may possibly inform us about the cultural background of MS. Opp. 688, fol. 162v as well as other related Hebrew manuscripts, Byzantine and Medieval texts. Furthermore, this research will position 4Q318 in its context within the wider Second Temple Jewish culture. This investigation also raises questions about the purpose of 4Q318 and *4QAstronomical Enoch*$^{a-b}$ (4Q208–4Q209) as functioning calendars and it offers evidence to show that 4Q318 is related to the Hebrew calendar today.[169]

This study takes a step towards creating a historical model and a methodology with which to examine ancient and medieval zodiacal calendars and the long history of the use of the zodiac, a history that many modern scientists, historians and ancient historians alike, and many Jewish and Christian theologians have not taken seriously. Some even refer to the concept of the zodiac calendar pejoratively. As a result, today, when we see a beautifully engineered medieval, monumental zodiacal clock, the extraordinary range of ancient and early modern zodiacal sundials or astrolabes, ancient zodiacal parapegmata, curious zodiacal references in ancient primary and secondary literature and manuscripts, classical scientific treatises involving the zodiac, evidence of the use of the zodiac in many manifestations materially scattered throughout the centuries and among different western and east-to-west cultures—a whole panoply of a highly developed, long-lived, now lost, popular, once-accessible intellectual tradition—most of us need to find an expert to inform us how to understand what we are looking at. It is like surveying the surviving debris from a glacier and wilfully ignoring or dismissing the historical forceful events that brought the remnants to where they landed.

169 A similar paradigm holds for 4Q208–4Q209.

CHAPTER 1

Towards A New Interpretation of *4QZodiac Calendar*

1.1 Introduction

This chapter will consider 4Q318 cols. iv, vii–viii, lines 1–6a (comprising *4QZodiac Calendar*) as an ideal calendar based on a late Babylonian calendrical system. By ideal, I am referring to a schematic paradigm, rather than to an idealistic model that was never meant for use. Before moving into the section of this chapter exploring the Mesopotamian origins of this part of the scroll, I will describe the manuscript, evaluate existing scholarship and look at possible alternative interpretations to the consensus view of its calendar. *4QZodiac Calendar* shall be compared with similar late Mesopotamian schemes, in order to contextualise its structure from a historical and a geographical perspective. The data in *4QZodiac Calendar* will be further compared to equivalent information in Babylonian horoscopes, which provide lunar data from ephemerides. In so doing, I will ask how the Qumran zodiac calendar may be related to similar, contemporaneous primary sources in the ancient Near East. It will be shown how 4Q318 is related to the Babylonian calendar and the Hebrew calendar. I shall also examine the cultural and chronological context of the technical textual features of *4QZodiac Calendar*: its zodiac sign names, month names and numerals. The discussion of the calendrical features of the text will then be followed by a full textual reconstruction on material grounds and the implications of the information in the restored text will be considered.

1.1.1 *Date*

The date when 4Q318 was copied and when it was deposited in the caves may be quite different, as is the case for all the Dead Sea Scrolls.[1] The latest date for all of the scrolls to be placed in their hiding places is the Roman destruction of Qumran in 68 C.E., but the copying of 4Q318 was probably much earlier. It is not known if 4Q318 was written at Qumran, or even in Judea, or if it may have been brought into the community. Yardeni attributes the orthography to an

1 J. Magness, *The Archaeology of Qumran and the Dead Sea Scrolls* (Grand Rapids, MI: Eerdmans, 2002), 89.

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"early Herodian date (late first century B.C.E.–the early first century C.E.)."[2] She describes the script as "book-hand," written "rapidly by a skilled scribe with attention to the details of the components for each letter, with some letters occasionally having a tendency to cursiveness." For reasons that are not clear, the Shrine of the Book, in Jerusalem, has assigned an alternative date to that proposed by Yardeni, moving its age back 100 years, to the late second century B.C.E.[3]

1.1.2 *Textual Structure and the 360-day Calendar*

The small, portable parchment scroll consists of two units, an ideal lunar zodiac calendar scheme followed by an associated thunder-omen text, the brontologion. The omen text gives an interpretation for the meaning of thunder according to the position of the moon when this meteorological event occurs. The restored calendar describes a schematic 360-day year, the number of degrees in the zodiac. The year is divided into 12 months, which have Babylonian-Aramaic month names, of 30 days each. Two Aramaic month names have survived: Shevat שבט (vii 4) and Adar אדר (viii 1).[4] The fragments of *4QZodiac Calendar* are the remains of a scheme that tabulates every day of the month, each one of which is schematically assigned to the position of the moon in the zodiac on that day.[5]

The fragments happen to be in fortuitous places in the calendar and provide valuable information about its structure. The smallest substantial fragment, 4Q318 col. iv, lines 5–9, contains a few days in Elul (Month VI) [the sixth month; the convention of using Roman numerals for month numbers has

2 A. Yardeni, DJD 36, 259–261 (esp. 260), pl. 16 (not pl. 17, as stated in the article). Herod ruled from 37 B.C.E.–4 B.C.E.

3 Display card and online catalogue entry for the "The Brontologion Scroll (4Q318)," Shrine of the Book, Israel Museum, Jerusalem. Online: http://www.imj.org.il//imagine/collections/results.asp?searchType=simple&words=brontologion&x=9&y=8.

4 Details in Chapter 1, Material reconstruction and measurements.

5 The ecliptic is defined by the apparent path of the sun, moon and the five planets (Mercury, Venus, Mars, Jupiter, and Saturn) among the stars. It is the plane where the eclipses of the sun and moon take place, hence its name. Beginning with the vernal equinox, the ecliptic is mathematically divided into 12 equal parts of 30° each: the zodiac signs, constituting the zodiacal belt. These are artificial constructions and do not correspond precisely to the zodiacal constellations whose name they bear. Adapted from Christopher Walker, ed., *Astronomy before the Telescope* (New York: St Martin's Press, 1996), 343–344; Ulla Koch-Westenholz, *Mesopotamian Astrology* (Cni Publications 19; Copenhagen: Museum Tusculanum Press, 1995), 30. See also J.M. Steele, "Celestial Measurements in Babylonian Astronomy," *Annals of Science*, 64.3 (2007): 293–325 (esp. 318–320).

been adopted] and Tishri (Month VII), days which fall around the mid-point of the calendar. The largest fragments, with lacunae, consist of the last two and half months at the end of the zodiac calendar (cols. vii–viii, lines 1–6a), covering just over the second half of the month of Tevet (Month X), and the whole of the months of Shevat (Month XI) and Adar (Month XII), where the calendar ends.

Of interest is that *4QZodiac Calendar* contains one Adar (4Q318 col. viii, lines 1–6a), not two, that is, there is not a separate intercalary Adar at the conclusion of the calendar;[6] the column then continues immediately with the brontologion. *4QBrontologion* (4Q318 col. viii, lines 6b–9) consists of the remains of the prognostications for the omen of thunder when the moon is in Taurus and Gemini. This starting point of the thunder book reflects the signs at the beginning of the restored zodiac calendar, which commences with the moon in Taurus, on days 1 and 2 of the first month, Nisan (Tables 1.1.3, and 1.7.3). As stated by Greenfield and Sokoloff, the formulaic arrangement can be easily restored on the basis of the textual remains in cols. vii–viii.[7]

Below, is a reconstruction of 4Q318 col. viii, lines 1–6a, the last month of the *4QZodiac Calendar* with *4QBrontologion* (4Q318 6b–9): the section describes the moon's journey through the zodiac for the month of Adar only. The first zodiac sign of the moon in Adar is Aries, on days 1 and 2 of the month. On days 3 and 4, it is in Taurus and on days 5, 6 and 7, it is in Gemini. This pattern of the moon in the same sign for two days, then another two days, then three days, is recurring.

4QZodiac Calendar viii 1–6a: Adar 1–Adar 30 and *4QBrontologion* 4Q318 6b–9

1 אדר ב/ וב// דכרא ב/// וב//// תורא ב//[/// וב////// וב/////// תאומיא]
2 ב/////// וב/////////ס[רטנא ב¬ וב¬/ א]ריא ב¬// וב[¬/// וב¬////]
3 בתו[לתא]ב¬///// וב[¬//////מוזניא ב¬//]///// ב¬///[///// עקרבא]
^3/^
4 [ב¬/]//////// וב3 קש[תא ב3// וב3///ג]דיא[ב3//// וב3/////]
5 דו[לא] ב3////// וב3[/////// וב3//////]/ נו[ניא ב3//////// וב3¬]
6 דכר[א] *vacat* [אם בתורא] ירעם מסבת על[
7 [ו]עמל למדינתא וחרב [בד]רת מלכא ובמדינת אב[
8 להוא ולערביא[ ]א כפן ולהוון בזזין אלן בא[לן] *vacat*
9 אם בתאומיא ירעם דחלה ומרע מנכריא ומ[*vacat*

6 Intercalation simply means adding an extra month in order for the lunar calendar to keep track with the sun's year.

7 Greenfield and Sokoloff, DJD 36, 259.

1. Adar. In 1 and 2 Aries, in 3 and 4 Taurus, in 5 [and in 6 and in 7 Gemini]
2. in 8 in 9 Cancer, [in 10 and 11 L]eo, in 12 and[in 13 and in 14]
3. Vir[go], in 15 and in [16 Libra, in 1]7 in 18 [Scorpio,]
4. in [1]9 and in 20, and < in 21 > Sagitt[arius, in 22 and in 23 Cap]ricorn, [in 24 and in 25]
5. Aquarius, in 26 and in 2[7 and in 28] Pi[sces and 29 and in 30]
6. Aries. Vacat [If in Taurus] it thunders (there will be) *msbt*[8] against
7. [and] affliction for the province, and a sword [in the cou]rt of the king and in the province of Ab?[
8. will be. And to the Arabs [ ], hunger, and they will plunder each oth[er *vac*]*at*
9. *vacat* If in Gemini it thunders, (there will be) fear and sickness from the foreigners and *m*[

(Transliteration and translation: Greenfield and Sokoloff, DJD 36, 263–264 {modified})

The brontologion will be analysed separately and as a composite text with the calendar in the next chapter. I will now move on to explain the ideal astronomical scheme in *4QZodiac Calendar* in further detail.

1.1.3 *The Lunar Zodiac in 4Q318*

The zodiac calendar consists of a table of 12 schematic months of 30 days each, constituting a 360-day year, as stated. Each month in this text begins with the sign following the one in which the moon's conjunction with the sun took place ('conjunction' is when the sun and moon have the same celestial longitude; it is sometimes referred to as 'syzygy.'[9] The term 'new moon' is best avoided). In the extant text, the month of Adar, the 12th month, which corresponds with Pisces, begins on days one and two when the moon is in Aries. The text assumes that day one is the first crescent, and that conjunction would have taken place in the sign before, when the moon was in Pisces at the same degree as the sun in Pisces. The moon completes circuit in Aries, on days 29 and 30 Adar (4Q318 viii 5, extant).

By reconstructing the formulaic arrangement of the remaining zodiac signs and dates, it is evident that the moon begins its journey in the sign of Taurus, in Month 1, Nisan, when the sun is in Aries. (Taurus is the sign after Aries). Greenfield and Sokoloff noted that the scheme was "not in accordance with

8 Yardeni suggests the second letter is a *tsade* (DJD 36, "Palaeography," 263). Discussed in Chapter 2.

9 I. Ridpath, *A Dictionary of Astronomy* (2nd revd. ed.; Oxford: Oxford University Press, 2012) (online version 2014).

the traditional pattern in Babylonian astronomical and astrological texts, in which Nisan began [with the moon] in Aries."[10]

Brack-Bernsen and Steele showed that in schematic, late Babylonian texts the 360-day zodiac calendar began when the sun was in Aries, and the moon was at 13° Aries on 1 Nisan.[11] This presupposes that the sun moves ideally at about 1° per day and the moon at 13° per day.[12] The Babylonian model assumes that the month began at the first visible crescent as with the civil calendar, therefore, the conjunction occurs at 0° Aries and the first crescent appears a day later. The full moon would therefore occur on day 15 in a 30-day month. This 360-day calendar is different to the standard Mesopotamian luni-solar calendar of 354 days, intercalated with a 30-day month seven times in 19 solar years.[13] The 360-day calendar and the standard Mesopotamian calendar of 354 days have apparent separate origins and perhaps, purposes; hence, there is also a concept of a calendrical plurality in Babylonia.

From 500 B.C.E. onwards, the 19-year cycle was established in Mesopotamia, though not in its final form. The Greek Metonic cycle (which began at the summer solstice, not the spring equinox) is attributed to Meton of Athens in 432 B.C.E., but the consensus view is that the Babylonians knew of it earlier, although it was not applied consistently in Mesopotamia until the late fourth century B.C.E.[14]

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10 Greenfield and Sokoloff, DJD 36, 264–265 notes 9, 11.

11 L. Brack-Bernsen and J.M. Steele, "Babylonian Mathemagics: Two Astronomical-Astrological Texts," in *Studies in the History of the Exact Sciences in Honour of David Pingree* (ed. C. Burnett et al.; Leiden: Brill, 2004), 95–121; Cf. Rochberg, *Heavenly Writing*, 131–133. Discussed in greater detail later in this chapter.

12 See also O. Neugebauer, *The Exact Sciences in Antiquity* (2nd ed.; New York: Dover 1969), 106–107.

13 In Babylonia, this was a second Adar (Month XII_2) and a second Ululu (Month VI_2) which began the cycle until it was discontinued in the 4th century B.C.E. during the reign of Artaxerxes I, but was resumed thereafter and continued in the Seleucid period; see Britton, "Treatments of Annual Phenomena in Cuneiform Sources" in *Under One Sky*, 21–78 (here 33–36, fig. 4); idem, "Calendars, Intercalations and Year lengths," in *Calendars and Years: Astronomy and Time in the Ancient Near East* (ed. J.M. Steele; Oxford: Oxbow Books, 2007), 122–124, fig. 7 (Britton places the adoption of the 19-year cycle to 484 B.C.E.); O. Neugebauer, *Astronomical Cuneiform Texts* (2nd ed.; 3 vols.; New York: Springer, 1983), 1.33 [abbrev. *ACT*]; idem, *The Exact Sciences in Antiquity* (2nd ed.; New York: Dover, 1982), 140; W. K. Pritchett and O. Neugebauer, *The Calendars of Athens* (Cambridge, MA: Harvard University Press, 1947), 3–14.

14 J. Britton and C. Walker, "Astronomy and Astrology in Mesopotamia," in *Astronomy before the Telescope*, 42–67 (here 46); D. Lehoux, *Astronomy, Weather and Calendars in the Ancient World* (Cambridge: Cambridge University Press, 2007), 89 n. 40, 90; D. Pingree,

In *4QZodiac Calendar*, the moon is also assumed to move at a schematic speed of 13° per day.[15] The schematic arrangement of 4Q318 does not deal with degrees and minutes; the moon spends two or three days in each sign, according to the formulaic arrangement in the text, until it has traversed the entire zodiac of 360° plus a further 30° in an ideal month of 30 days, when it returns to the same phase. Thus, the months are synodic, that is, the moon returns to the same successive phase, travelling 390° in about 29.53 days moving schematically at 13° per day: it orbits the earth in 360° in addition to the time that the earth has moved about 30° around the sun in that period. Wise observes that because each of the 12 signs is assigned 30° in the zodiac, the moon travels approximately 390° in 30 days.[16] The moon passes through the same zodiac sign at the beginning and again at the end of the month. It moves through the 12 zodiac signs with the extra sign of 30° that it transits on schematic days 29 and 30 at the end of the month, which is the same zodiac sign as the one that it orbits on days 1 and 2 of the month. As Pingree explains, the moon travels through 13 signs to reach to same successive phase in a synodic month that it started from, with the 13th sign being the first sign transited twice.[17]

"Mesopotamian Astronomy and Astral Omens in Other Civilizations," *Mesopotamien und Seine Nachbarn* 3.7 (1978): 619; J. Evans, *The History and Practice of Ancient Astrono*my (New York: Oxford University Press, 1998), 185–186; A.C. Bowen and B.R. Goldstein, "Meton of Athens and Astronomy in the Late Fifth Century B.C.," in *A Scientific Humanist: Studies in Memory of Abraham Sachs* (ed. E. Leichty et al.; OPSNKF 9; Philadelphia: The Museum Press, 1988), 39–82 (42–45, 42 n. 17); G.J. Toomer, "Ptolemy and his Predecessors," in *Astronomy before the Telescope*, 70–1; Walker and Britton, "Astronomy and Astrology in Mesopotamia," in *Astronomy before the Telescope*, 46; Stern, *Calendar and Community*, 31 n. 137; Rochberg, *The Heavenly Writing*, 239–240; B.R. Goldstein, "A Note on the Metonic Cycle," *Isis* 57.1 (1966): 115–116 (esp. 115); B.R. Goldstein and A.C. Bowen, "A New View of Early Greek Astronomy," *Isis*, 74.3 (1983): 330–340 (337); A.E. Samuel, *Greek and Roman Chronology* (HdW I, 7; Munich: Oscar Beck, 1972), 21–22; R. Hannah, *Greek and Roman Calendars* (Duckworth: London, 2005), 55–58; F. Rochberg, "Astronomy and Calendars in Ancient Mesopotamia," in *Civilizations of the Ancient Near East* (ed. J.M. Sasson; 4 vols.; New York: Schreibner, 1995), 3.1925–1940 [Abbrev. *CANE*]; even after the institution of the 19-year cycle, 1 Nisannu could vary within a 27-day range, but averaged 14 days following the vernal equinox (Rochberg, *CANE*, 3.1931). This subject is discussed at greater length in the section on intercalation.

15 Pingree, DJD 36, 271, 273, table 2 (more precisely, Pingree states that the mean lunar velocity is 13; 10, 35° [13° 10' 35"], which is not schematic. Pingree's table does not apply to the scheme in 4Q318 which allows for a lunar orbit of a schematic 13° per day.

16 Wise, "Thunder in Gemini," 37 (13° × 30 days = 390°).

17 Pingree: "Note that, since this is a synodic month, the Moon travels through *thirteen* signs between its conjunctions with the Sun," in "4Q318," Greenfield and Sokoloff,

The full schematic, astronomical arrangement of zodiac signs in 4Q318 as described above for Adar, is as follows for all 12 months: 2–2–3–2–2–3–2–2–3–2–2–3–2–2–3–2: that is, Month I, Nisan: 2 days (in Taurus); 2 days (in Gemini); 3 days (in Cancer); 2 days (in Leo); 2 days (in Virgo); 3 days (in Libra); 2 days (in Scorpio); 2 days (in Sagittarius); 3 days (in Capricorn); 2 days (in Aquarius); 2 days (in Pisces); 3 days (in Aries); 2 days (in Taurus, thus, transited twice) = 30 days. In Month II, Iyyar, the moon begins in Gemini (2 days), follows the same pattern, and ends in Gemini, and so on, for the next 10 months: Sivan, Tammuz, Av, Elul, Tishri, Marchesvan, Kislev, Tevet, Shevat, and Adar.

Below is a numerical reconstruction of 4Q318 as a schematic lunar zodiac within a schematic, ideal, 360-day calendar (see Table 1.1.3). The shaded area represents the days of the month on the surviving fragments (the textual reconstruction is reproduced in Table 1.7.3 at the end of this chapter). The term 'lunar zodiac' in this context means that the calendar describes the daily schematic journey of the moon through the zodiac signs, month by month. The lunar zodiac allows one day for each degree of the sun's movement through the zodiac in a year (that is, 360° in a schematic year of twelve 30-day months) and equivalently, 13° per day for the moon's motion.

Table 1.1.3 reconstructs the arrangement in a grid with the months across the top and the days, numbered 1–30, in the first column. The zodiacal order of signs that the moon traverses runs vertically from day one under each month. The length of time that the moon stays in each sign on the days of the months can be tracked by looking at the grid across the rows; the signs also run in consecutive order for the same days of each of the months. When so-arranged, the graph shows that the zodiac signs traversed by the moon each month run in their consecutive order horizontally across the year, as well as vertically through the months. There has been an in-depth scholarly discourse on the reasons why this text should begin in Taurus and not in Aries; the next subsection will review the history of scholarship on *4QZodiac Calendar* and discuss this intriguing question.

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ed. "Astronomical Aspects," DJD 36, 271; also Pingree, "Appendix I. Astronomical Considerations," in Greenfield and Sokoloff, ed. "An Astrological Text from Qumran (4Q318) and Reflections on Some Zodiacal Names," *RevQ* 16 (1995) 518. A synodic month is the period between successive lunar phases: 29 days, 12 hours, 44 minutes and 2.8 seconds. The mean synodic month is 29.53 days. See *Astronomy before the Telescope*, 345; Koch-Westenholz, *Mesopotamian Astrology*, 31; O. Neugebauer, *A History of Ancient Mathematical Astronomy* (3 vols.; Berlin: Springer, 1975), 1084 [Abbrev. *HAMA*].

TABLE 1.1.3 4QZodiac Calendar *reconstructed to show the lunar zodiac*

	Nisan	Iyyar	Sivan	Tammuz	Av	Elul	Tishri	Heshvan	Kislev	Tevet	Shevat	Adar
1	♉	♊	♋	♌	♍	♎	♏	♐	♑	♒	♓	♈
2	♉	♊	♋	♌	♍	♎	♏	♐	♑	♒	♓	♈
3	♊	♋	♌	♍	♎	♏	♐	♑	♒	♓	♈	♉
4	♊	♋	♌	♍	♎	♏	♐	♑	♒	♓	♈	♉
5	♋	♌	♍	♎	♏	♐	♑	♒	♓	♈	♉	♊
6	♋	♌	♍	♎	♏	♐	♑	♒	♓	♈	♉	♊
7	♋	♌	♍	♎	♏	♐	♑	♒	♓	♈	♉	♊
8	♌	♍	♎	♏	♐	♑	♒	♓	♈	♉	♊	♋
9	♌	♍	♎	♏	♐	♑	♒	♓	♈	♉	♊	♋
10	♍	♎	♏	♐	♑	♒	♓	♈	♉	♊	♋	♌
11	♍	♎	♏	♐	♑	♒	♓	♈	♉	♊	♋	♌
12	♎	♏	♐	♑	♒	♓	♈	♉	♊	♋	♌	♍
13	♎	♏	♐	♑	♒	♓	♈	♉	♊	♋	♌	♍
14	♎	♏	♐	♑	♒	♓	♈	♉	♊	♋	♌	♍
15	♏	♐	♑	♒	♓	♈	♉	♊	♋	♌	♍	♎
16	♏	♐	♑	♒	♓	♈	♉	♊	♋	♌	♍	♎
17	♐	♑	♒	♓	♈	♉	♊	♋	♌	♍	♎	♏
18	♐	♑	♒	♓	♈	♉	♊	♋	♌	♍	♎	♏
19	♑	♒	♓	♈	♉	♊	♋	♌	♍	♎	♏	♐
20	♑	♒	♓	♈	♉	♊	♋	♌	♍	♎	♏	♐
21	♑	♒	♓	♈	♉	♊	♋	♌	♍	♎	♏	♐
22	♒	♓	♈	♉	♊	♋	♌	♍	♎	♏	♐	♑
23	♒	♓	♈	♉	♊	♋	♌	♍	♎	♏	♐	♑
24	♓	♈	♉	♊	♋	♌	♍	♎	♏	♐	♑	♒
25	♓	♈	♉	♊	♋	♌	♍	♎	♏	♐	♑	♒
26	♈	♉	♊	♋	♌	♍	♎	♏	♐	♑	♒	♓
27	♈	♉	♊	♋	♌	♍	♎	♏	♐	♑	♒	♓
28	♈	♉	♊	♋	♌	♍	♎	♏	♐	♑	♒	♓
29	♉	♊	♋	♌	♍	♎	♏	♐	♑	♒	♓	♈
30	♉	♊	♋	♌	♍	♎	♏	♐	♑	♒	♓	♈

Key: Aries ♈; Taurus ♉; Gemini ♊; Cancer ♋; Leo ♌; Virgo ♍; Libra ♎; Scorpio ♏; Sagittarius ♐; Capricorn ♑; Aquarius ♒; Pisces ♓

1.2 Scholarship on 4Q318: Setting the Problem

Following the unofficial publication of 4Q318 by Eisenman and Wise,[18] a large proportion of the scholarship on *4QZodiac Calendar* focussed on the apparent anomaly that the calendar began with the moon in Taurus, rather than in Aries. Prior to its unofficial publication in 1992, little was known about the text, aside from very basic information. Milik initially mentioned the Qumran zodiac calendar, generically, as a "horoscope," in 1957.[19] He noted that the signs of the zodiac were distributed over the days of the month and that the text with the brontologion was virtually identical to a medieval compendium of folklore, *Geoponica* 1.10.[20]

Milik's reference to 4Q318, then without a siglum, was cited by Beckwith in an article in 1970 to support the latter's hypothesis that the 'gates' in the Ethiopic Astronomical Book of Enoch (*1 En.* 72–82) were connected with the zodiac.[21] Milik, tantalisingly, referred to 4Q318 again, still without a title or siglum, or any details, in his study on the Aramaic fragments of the Book of Enoch in the Dead Sea Scrolls, published in 1976. This was in the context of discussing an astronomical term in the Aramaic fragment *4QEn*^{c} ar (4Q204) frag 1 col. i line 19 (= *1 En.* 2:1). Milik translated the word מסורת in line 19, as "station," and compared the use of the term in *4QEnastr*^{b} *ar* (4Q209, later scholars use the title *4QAstronomical Enoch*^{b} *ar*) frag 28 line 2 (= *1 En.* 82.10). Milik then related the word linguistically to that in the *Maskil's Hymn* in the Community Rule (1QS col. x line 4); he argued that the pericope 1QS col. x lines 1–5 was a reference to the "constellations (of the Zodiac)".[22] Greenfield and Sokoloff also made an early, untitled reference to 4Q318 in their article on a Byzantine Jewish liturgical text that contained astrology and Babylonian omens, before they published the critical edition of the Qumran zodiac calendar and brontologion.[23]

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18 R. Eisenman and M.O. Wise, *The Dead Sea Scrolls Uncovered* (London: Penguin, 1992), 258–263, pl. 23.

19 J.T. Milik, *Ten Years of Discovery in the Wilderness of Judea* (trans. J. Strugnell; SBT 26; London: SCM, 1959), 42.

20 See also Chapter 2.

21 R.T. Beckwith, "The Modern Attempt to Reconcile the Qumran Calendar with the True Solar Year," *RevQ* 7:27 (1970): 379–396 (at 394). See Chapter 3.

22 J.T. Milik, *The Books of Enoch*, 187. The translation has been accepted by Drawnel, *The Aramaic Astronomical Book* (4Q209 frag 28 = *1 En.* 82:9–13), 198–200. See pp. 249–250.

23 J.C. Greenfield and M. Sokoloff, "Astrological and Related Texts in Jewish Palestinian Aramaic," *JNES* 48.3 (1989): 201–214 (at 202, 213).

After the publication of 4Q318 by Eisenman and Wise, there were detailed studies by Albani,[24] Wise[25] and Greenfield and Sokoloff.[26] In addition, Greenfield published a separate, fully detailed study of the background and etymology of the Aramaic names of the zodiac signs in 4Q318.[27] The next sub-section will discuss the various solutions that scholars have suggested to account for the difference between the zodiacal order in 4Q318 and ideal zodiac schemes in the ancient Near East: why 4Q318 begins with the moon in Taurus and not in Aries.

1.2.1 *The Question of the* thema mundi *and MUL.APIN*

In order to explain why the *4QZodiac Calendar* began with the moon in Taurus, Eisenman and Wise suggested that 4Q318 was a *thema mundi*, a 'world horoscope,' commencing with the biblical Creation of the world.[28] They argued that due to the precession of the equinoxes, in c.4,000 B.C.E., the sun would have been at the beginning of Taurus at the spring, or vernal, equinox.[29] Since *4QZodiac Calendar* begins in Taurus, Eisenman and Wise argued that the authors of 4Q318 believed that Taurus was the sign at the vernal equinox at

24 M. Albani, "Der Zodiakos in 4Q318 und die Henoch-Astronomie," *MBFJTFL* 7 (1993): 3–42; Albani, *Astronomie und Schöpfungsglaube*, 83–87; Albani, "Horoscopes in the Qumran Scrolls," 2:296–301; Albani, "Horoscopes," *EDSS*, 1:370–373.

25 Wise, *Thunder in Gemini*, 13–50.

26 J.C. Greenfield and M. Sokoloff, with A. Yardeni and D. Pingree, "An Astrological Text (4Q318) and Reflections on Some Zodiacal Names," *RevQ* 16/ 64: (1995): 507–525 and idem, DJD 36, 259–274.

27 J.C. Greenfield, "The Names of the Zodiac Signs in Aramaic and Hebrew," in *Au Carrefour des Religions* (ed. Rika Gyselen; RO 7; Bures-sur-Yvette: GECMO, 1995): 95–103 (see also Chapter 1.5: The zodiac sign-names in 4Q318).

28 Eisenman and Wise, *Dead Sea Scrolls Uncovered*, 258–259.

29 At the vernal (spring) and autumn equinox the sun rises due east and sets due west. Since the time of Ptolemy, the vernal equinox is also known as the First Point of Aries. The plane of the ecliptic intersects with the celestial equator at an angle of 23° 27'. The two points of intersection are the vernal and autumn equinoxes. The equinoxes move westwards on the ecliptic (counter-clockwise): slipping "backwards" 13° 50' in 1000 years (about 1° every 72 years; some 2,160 years per zodiac sign). This is known as precession. More than 2,000 years before Ptolemy, the vernal equinox was in Taurus. Adapted from *Astronomy before the Telescope*, 343–344 and Koch-Westenholz, *Mesopotamian Astrology*, 23–25. O. Neugebauer, "The Alleged Babylonian Discovery of the Precession of the Equinoxes," *JAOS* 70 (1950): 1–8; O. Neugebauer, *HAMA*, 631–634; F. Rochberg, *The Heavenly Writing* (Cambridge: Cambridge University Press, 2004), 128; B.E. Schaefer, "Origin of the Greek Constellations," *Scientific American* 295.5 (2006): 96–101; Wise, *Thunder in Gemini*, 39–48.

the biblical Creation.[30] The theory of the precession of the equinoxes is credited to Hipparchus, although Neugebauer argued that it cannot be verified before the time of Ptolemy (mid-first century C.E.).[31]

The theory of the *thema mundi* is also related to the hypothesis that the sequence of signs in *4QZodiac Calendar* reflects the path of the moon in MUL.APIN, the canonical Akkadian astronomical compendium containing details about the constellations, intercalation schemes and omens.[32] MUL.APIN also describes the path of the moon commencing in the constellation of the Pleiades, part of the zodiacal constellation of Taurus (MUL.APIN Tablet I iv 31–39).[33] Albani considered and rejected the idea that 4Q318 was a *thema mundi* after taking the idea one step further and applying an astrological framework.[34] However, he postulated that there was a relationship between the beginning of 4Q318 in Taurus and MUL.APIN (Tablet I iv 31–39). This theory was based on the work of earlier scholars such as Papke and van der Waerden who argued that the Akkadian compendium was founded on data compiled in the late third millennium B.C.E.,[35] hence, according to the

30 Eisenman and Wise, *Dead Sea Scrolls Uncovered*, 259; Wise, *Thunder in Gemini*, 39–48 (esp. 45–46).

31 Neugebauer, *HAMA*, 122–128, 340, 593–594, 600; G.J. Toomer, *Ptolemy's Almagest* (London: Duckworth, 1984), 138–140 (*Almagest*. Bk 3:1), 327–338 (*Almagest*. Bk 7:2, 3); Toomer, "Ptolemy and Greek Predecessors," in *Astronomy before the Telescope*, 80–81.

32 H. Hunger and D. Pingree, *MUL.APIN: An Astronomical Compendium in Cuneiform* (*AfO* Supplement 24; Horn: Ferdinand Berger & Söhne, 1989), 144. Copies of MUL.APIN date to the period of Ashurbanipal's library in Kouyunjik (Nineveh) (early seventh century B.C.E.) and the later Hellenistic period as shown by the name of a king Seleucus, see Hunger and Pingree, *MUL.APIN*, 9. It is thought that some parts date to 1000 B.C.E.; Hunger and Pingree, *MUL.APIN*, 10–12; see Rochberg, *Heavenly Writing*, 6–7; H. Hunger and D. Pingree, *Astral Sciences in Mesopotamia* (Leiden: Brill, 1999), 57–84. For an accessible explication of *MUL.APIN* and a critique of scholarship, see J.L. Cooley, *Poetic Astronomy in the Ancient Near East* (Winona Lake, IN: Eisenbrauns, 2013), 11–12, 51–52, 62–72.

33 Hunger and Pingree, *MUL.APIN*, 67–69, 144 (List VI); R. Watson and W. Horowitz, *Writing Science before the Greeks*: *A Naturalistic Analysis of the Babylonian Astronomical treatise MUL.APIN*. (CHANE 48; Leiden: Brill, 2011), 84–86.

34 Albani, "Zodiakos," 23–26, Abb 2. He reconstructed a putative Creation chart using the position of the sun, moon and the planets in their signs of "exaltation," based on Rochberg's work on the *bīt niṣirti*, 'place of secrets'—, "Elements of the Babylonian Contribution to Hellenistic Astrology," *JAOS* 108, 51–62 (at 53–57)—where they would be theoretically at the time of the world's birth.

35 Albani, "Zodiakos," 27–35; Hunger and Pingree, *MUL.APIN*, 67–69 (Tablet I iv 31–39), 144; W. Papke, "Zwei Plejaden-Schaltregeln aus dem 3. Jahrtausend," *AfO* 31 (1984): 67–70, followed by "Remarks on the Article 'Zwei Plejaden-Schaltregeln'" by D.E. Pingree on 70–71,

thema mundi model, a possible time of Creation. Hunger and Pingree refuted Papke's argument for such an early composition of MUL.APIN on the basis that the astronomical position of the constellations fits a date of composition of between c.1000 B.C.E. and c. late eighth century B.C.E.[36] They also contended that MUL.APIN was composed in Assyria. Although MUL.APIN was copied for several hundred years until the late Babylonian period,[37] it is not known if it was preserved in order to be used, or if it was transmitted and copied throughout the centuries for the sake of preserving ancient works for antiquarian purposes, or because it was a canonical work.[38]

MUL.APIN Tablet I iv 31–39 lists 17 constellations which the moon touches in its path in the course of a month.[39] These begin with the Pleiades, called the Stars, MUL.MUL (Tablet I iv 33) and the Bull of Heaven, which are in the zodiac sign of Taurus.[40] The moon's path in this month ends with the Hired Man, the Babylonian sign for Aries, (Tablet I iv 37).[41] Greenfield and Sokoloff accepted Albani's observation that the path of the moon in the order of the constellations of the month described in MUL.APIN was reflected in the first month of *4QZodiac Calendar*.

> A convincing explanation for this [the first month beginning in Taurus] was proposed by Albani who suggested that this text follows the order of MUL.APIN, which began with the constellations Pleiades and Taurus in Nisannu and concluded with Aries (Tablet I, col. iv lines 33–39).[42]

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cited by Albani, "Zodiakos," 32; B.L. van der Waerden, "Babylonian Astronomy II: The Thirty-Six Stars," *JNES* 8 (1949): 6–36 (at 14–17).

36 Hunger and Pingree, *MUL.APIN*, 9–12; Hunger and Pingree, *Astral Sciences*, 57. B. Schaefer has argued that the star mapping in MUL.APIN corresponds to ca. 1370 B.C.E., observed in Assur, in "Origin of the Greek Constellations," *Scientific American* 295.5 (Nov 2006): 96–101.

37 Hunger and Pingree, *Astral Sciences*, 57.

38 For a discussion on the meaning of canonicity in ancient Near East texts see F. Rochberg, "Canonicity in Cuneiform Texts," *JCS* 36 (1984): 127–144; she argues that the meaning "points to the high regard to the traditions of scholarship which the scholars themselves traced back to the sages of the time before the legendary Flood" and that this idea is separate from that in the Hebrew Bible and New Testament where the term is associated with theological concepts of the sacred (esp. 144).

39 Hunger and Pingree, *MUL.APIN*, 67–69.

40 Hunger and Pingree, *MUL.APIN*, 68.

41 Hunger and Pingree, *MUL.APIN*, 68–69; Greenfield and Sokoloff, DJD 36, 264–265, 270.

42 Greenfield and Sokoloff, DJD 36, 265, 265 n. 11.

Geller also posited a correspondence between MUL.APIN and 4Q318 as the possible reason that both the Qumran zodiac calendar and brontologion began in with the moon in Taurus.[43] However, although the moon's orbit in the month of Nisan begins in Taurus in 4Q318, its path in the first month of *4QZodiac Calendar* ends in Taurus, not in Aries, as is the case in MUL.APIN. Since the moon travels 390° in the Qumran zodiac calendar, it describes synodic months, as discussed above; the moon's path in the first month in 4Q318 begins and ends in Taurus. Therefore, while not dismissing its mathematical and astronomical inheritance, 4Q318 cannot be said to be following MUL.APIN Tablet I iv 31–39, which begins in Taurus and ends in Aries. In order to make the texts agree would mean further speculation that *4QZodiac Calendar* was a variant or a modified version of MUL.APIN Tablet I iv 31–39; this becomes even more methodologically untenable. Furthermore, Hunger and Pingree have calculated that in some textual layers of MUL.APIN, the Hired Man [Aries] rises on 1 Nisannu (Month I) and the rising of the Pleiades [in Taurus] occurs on the 1 Ajjaru (Month II).[44] Francesca Rochberg pointed out that although in MUL.APIN the path of the moon commences in the constellation of the Pleiades, Babylonian texts reflect a starting point of the zodiac in Aries, although, the precise "zodiacal norming points cannot be pinpointed":

> Although the original list of stars in the "path of the moon" began at the end of Aries, specifically with the Pleiades . . ., the zodiac, when it is enumerated in texts, begins with Aries.[45]

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43 M.J. Geller, "New Documents from the Dead Sea: Babylonian Science in Aramaic," in *Boundaries of the Ancient Near Eastern World* (ed. M. Lubetski; JSOTSS 273; Sheffield: Sheffield Academic Press, 1998), 224–227.

44 Hunger and Pingree, *Astral Sciences*, 65; Hunger and Pingree, *MUL.APIN*, 11; see also B.L. van der Waerden, "History of the Zodiac," *AfO* 16 (1952–1953), 216–230 (at 221).

45 Rochberg, *Heavenly Writing*, 133; Neugebauer, *HAMA*, 594 n. 10. The Babylonian zodiac, according to some scholars, begins at 0° Aries, see J. Gray, *A Study of Babylonian Goal-Year Planetary Astronomy* (Ph.D. thesis. Durham University, 2009), Online: http://etheses.dur.ac.uk/101/, 21–22, table 1.5; Steele, "Celestial Measurement in Babylonian Astronomy," 302–303.

Rochberg, *Heavenly Writing*, 132, states the counting of zodiac signs from Aries is a consequence of the relationship between the constellations and "the twelve schematic months of the year", while acknowledging that the stars "in the path of the moon" began at the end of Aries with the Pleiades, following P.J. Huber, "Über den Nullpunkt der babylonischen Ekliptik," *Centaurus* 5 (1958), 192–208 (at 198–199); Neugebauer also explains that the Babylonian sidereal zodiac did not begin at the vernal point, which was fixed at

Another intriguing consideration is the fact that David Pingree, the co-editor of the critical edition of MUL.APIN and the commentator on the astronomical background to 4Q318 in the *editio princeps*, did not mention MUL.APIN in connection with 4Q318, as per Albani.[46] By contrast, he identified the transmission of elements of MUL.APIN to Vedic astronomy[47] and he argued that the brontologion of 4Q318 might be descended from the Akkadian omen series *Enūma Anu Enlil* (*EAE*).[48]

As Rochberg suggests, MUL.APIN used zodiacal constellations boundaried by exemplary stars, rather than the zodiac—used in *4QZodiac Calendar*—which was a much later construct, at around 400 B.C.E.[49] For all of the above reasons, a direct comparison between the structure of the "path of the moon" section of the Akkadian star and omen corpus, MUL.APIN, and the zodiacal order of 4Q318 is, I argue, rather forced. Furthermore, there is no textual support for the theory of a *thema mundi* in the first century B.C.E. The forecasts for the king and country in *4QBrontologion* seem strange in that elaborate hypothesis. How would a related thunder omen text fit into a scheme about the horoscope of the world?

I suggest that the theory presented by Greenfield and Sokoloff, following Albani, ascribing the sequence of the zodiac signs in *4QZodiac Calendar* to MUL.APIN Tablet I iv 31–39 should be replaced by a contemporaneous astronomical model. This proposal would be in keeping with Rochberg's analysis of the process of scholarship in Babylonia: the scientific elements of astronomy were reflected in innovations in science, while prognostications, such as omens and horoscopes, remained traditional.[50] She suggests that the same scribes were involved in computing astronomical phenomena and data,

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10° and 8°, and that planetary longitudes were measured from 0° Aries (the vernal point in the tropical zodiac from before the time of Ptolemy, c.150 C.E.), *HAMA*, 593–594, 600.

46 Pingree, "Astronomical Aspects," DJD 36, 270–272.

47 Hunger and Pingree, *Astral Sciences*, 63; D. Pingree,"Legacies in Astronomy and Celestial Omens," in *The Legacy of Mesopotamia* (ed. Stephanie Dalley; Oxford: Clarendon, 1998), at 127–128, 130; Pingree, "MUL.APIN and the Vedic Astronomy" in *DUMU-E2-DUB-BA-A* (ed. H. Behrens et al.; Philadelphia: University Museum Press, 1989), 442; Pingree, "Astronomy in India," in *Astronomy before the Telescope*, 123.

48 Pingree, "Astronomical Aspects," DJD 36, 272 (EAE overview: Gray, "A Study of Planetary Goal-Year Planetary Astronomy," 14–15; Rochberg, *Heavenly Writing*, 66–78).

49 J.P. Britton, "Studies in Babylonian Lunar Theory, Part III: The Introduction of the Uniform Zodiac," *Arc. Hist. Exact Sci.* 64 (2010): 617–663 (esp. 618, 639); Rochberg, *Heavenly Writing*, 132–133; Steele, "Celestial Measurement in Babylonian Astronomy," 306–310.

50 Rochberg, *Heavenly Writing*, 8–13, 62–65; Rochberg, "A consideration of Babylonian astronomy within the historiography of science," *Stud. Hist. Phil. Sci.* 33 (2002): 661–684.

copying omen texts and constructing horoscopes.[51] Rochberg observes, with regards to the *Enūma Anu Enlil* and Mesopotamian science, that literary omen texts were faithfully copied by successive generations of scribes—the "scribes of Enūma Anu Enlil," the "*ṭupšar Enūma Anu Enlil*" from the Neo-Assyrian to the Arsacid period.[52] The generic term, *ṭupšar*, referred to scribes specialising in celestial science, that is, both astronomy and astrology, although "Babylonian celestial sciences of the last three centuries B.C.E. differed considerably from those of the seventh century B.C."[53]

In contrast to the omina, the astronomical-astrological and mathematical cuneiform texts incorporated contemporary innovations, changes and developments in scientific knowledge over the periods of time in which they were written.[54] Thus, it is unlikely that *4QZodiac Calendar* would be anachronistically echoing the "path of the moon" from MUL.APIN and commencing in Taurus for that reason.

Some later scholars have supported Eisenman and Wise and disputed the consensus view of Greenfield and Sokoloff. For instance, von Stuckrad does not dismiss Wise's hypothesis that the zodiac calendar represented a *thema mundi.* He argues that the composers of 4Q318 would have been aware that the beginning of spring had migrated from Taurus to Aries, even if the authors were not familiar with Hipparchus's theory of the precession of the equinoxes.[55] It is unclear, however, how these longitudinal observations would have been transmitted and recorded; von Stuckrad does not offer any supporting evidence.

Böttrich focuses on the use of zodiac signs in 4Q318 and he finds it significant that, like *Slavonic Enoch* (*2 Enoch*), 4Q318 is overt in its use of the zodiac and that the Ethiopic Astronomical Book is not.[56] He further connects the elements of the zodiac and thunder in 4Q318 with those themes in *2 Enoch*, noting that they are integrated. Although these common elements exist, the date of composition of Slavonic Enoch is uncertain[57] and it may be methodologi-

51 Rochberg, "A consideration," 680.

52 Rochberg, *Heavenly Writing*, 70–71.

53 Rochberg, *Heavenly Writing*, 71.

54 F. Rochberg, "Continuity and Change in Omen Literature," in *Munuscula Mesopotamica: Festschrift für Johannes Renger* (ed. Barbara Böck et al.; Münster: Ugarit, 1999), 415–425.

55 K. von Stuckrad, *Das Ringen um die Astrologie* (Berlin: Walter de Gruyter, 2000), 204–215 (at 214–215).

56 C. Böttrich, "Astrologie in der Henochtradition," *ZAW* 109.2 (1997): 222–245.

57 N. Forbes and R.H. Charles posited a date of 1–50 C.E., see "2 Enoch or the Book of Secrets of Enoch," in *APOT* 2:425–469 (at 429); F.I. Andersen, "2 (Slavonic Apocalypse) Enoch," *OTP* 1.91–221 (at 94–97). Andersen favours a "rather late" date for the "original nucleus."

cally insecure to make this comparison. Böttrich conjectures that the authors of the Ethiopic Astronomical Book suppressed the zodiac on anti-astrological, theological grounds. He hypothesises that they did this despite its dependency on Babylonian astronomy, which, he states, scientifically fostered astrology. He regards it as significant that 4Q318 is later, as if a prohibition on astrology were less stringently applied later in Judean society, or at Qumran. I would respond that there may be too many assumptions in this hypothesis and that his theoretical model appears to reflect a modern theological perspective, that is, that astrology was prohibited in early Judaism (but not, somehow with respect to 4Q318 and 4Q186), when there is no evidence to support this assertion.[58]

Many of the main issues in the scholarship on 4Q318 have been summarised by Leicht who observes that not all of the questions raised by the text, particularly with regards to its cultural eclecticism, have yet been sufficiently explained in existing studies.[59] He agrees with previous scholars that *4QBrontologion* is extremely close to parallel Greek thunder omens, as supported by Byzantine texts; these, in turn, are descended from Mesopotamian *Vorlagen*; and the zodiac calendar is related to the 360-day year calendar of Mesopotamia. This unusual scroll, he concurs, contains two traditions: Mesopotamian astronomy and a Hellenistic prediction text: both in Aramaic.[60]

The discussion on the *thema mundi* and MUL.APIN aside, Greenfield and Sokoloff did not reconstruct the zodiac calendar of 4Q318 fully, either textually or materially. There is some kind of theoretical restoration of the formulaic pattern for cols. i–iv and cols. v–vi, [61] but the text has been restored horizontally, beginning at 4Q318 col. i line 1 (Nisan 1 and 2, moon in Taurus) with the month ending at 4Q318 col. iv line 1 (Nisan 29, 30, moon in Taurus). This makes no sense at all. A horizontal restoration of the months across four columns does not correspond with the textual pattern of the authors' own transliteration of the extant columns, which very clearly shows that the text runs vertically.[62]

Böttrich agrees with Charles in suggesting a date prior to 70 C.E., see C. Böttrich, "Recent Studies in the Slavonic Book of Enoch," *JSP* 9 (1991): 35–42 (at 40). The theme of thunder is discussed further in Chapter Two.

58 The issue of the zodiac in the Astronomical Book of Enoch in the Dead Sea Scrolls is discussed in Chapter Three.

59 R. Leicht, *Astrologumena Judaica* (Tübingen: Mohr Siebeck, 2006), 18–24.

60 Leicht, *Astrologumena Judaica*, 24; so Ben-Dov, *Head of All Years*, 256–257, but cf. Ben-Dov, "Scientific Writings in Aramaic and Hebrew at Qumran: Translation and Concealment," in *Aramaica Qumranica*, 388, states, "4Q318 is a product of the Hellenistic cultural furnace rather than of direct Mesopotamian influence."

61 Greenfield and Sokoloff, DJD 36, 265–266.

62 Greenfield and Sokoloff, DJD 36, 262–264, pl. 15.

Albani published the first arrangement of 4Q318 according to an ideal 360-day year composed of 12 months of 30 days each,[63] realising that it was based a Babylonian model.[64] The content of this table is correct, but it is difficult to read comfortably, and, therefore, to understand easily. Since 4Q318 describes a zodiac calendar and there are 360 degrees in the zodiac, *4QZodiac Calendar* could only have 360 days. Wise compiled a readable restoration of how the moon's movements could be theoretically reconstructed, except that he reconstituted the pattern on the basis of what he thought was a 364-day calendar and he did not recognise its Mesopotamian origins.[65] This stage in the history of scholarship is discussed below.

1.2.1.1 The 360-Day Calendar as a Qumran Issue

The early scholarship on *4QZodiac Calendar* was heavily influenced by the parallel research on the calendars at Qumran and, hence, the general debate on the relationship between the length of the year in the Hebrew Jubilees-Qumran calendrical scrolls and the evidence for a possible sectarian, or presumed Essene, composition. This discourse led to the failure of Eisenman and Wise, and Wise, separately, to properly distinguish between the structure of the year in 4Q318 and the 364-day calendars of the priestly courses.[66] Wise assumed that *4QZodiac Calendar* followed the structure of the 364-day year, as reflected in the Qumran calendars of the priestly courses.[67] He did not argue that *4QZodiac Calendar* was part of a triennial or sexennial cycle, but he reluctantly rejected his own (in my view, correct) hypothesis that the months in the Qumran zodiac calendar began at the lunar crescent because he presumed that this Aramaic calendar would follow the same pattern as the Hebrew corpus.[68]

Wise had first considered the astronomical solution: that the zodiac calendar could describe the moon as a lunar crescent in Taurus, and he suggested that the sun stood at 19°Aries at the Creation.[69] (The zodiac signs are 30° wide

63 Albani, "Horoscopes in the Qumran Scrolls," 2.298–299, fig. 3.

64 Albani, "Der Zodiakos," 20–21.

65 Wise, *Thunder in Gemini*, 22, Table 1.

66 Eisenman and Wise, *Dead Sea Scrolls Uncovered*, 261–263.

67 Wise, *Thunder in Gemini*, 17–22.

68 Wise, *Thunder in Gemini*, 39–42, 20–21 n. 21. Wise cites S. Talmon, "The Calendars of the Covenanters of the Judean Desert," in *The World of Qumran from Within: Collected Studies* (Jerusalem: Magnes, 1989), 147–185.

69 Wise, *Thunder in Gemini*, 40–43. The source that Wise used to suggest that the sun stood at 19° Aries at Creation was the article by Stefan Weinstock concerning a Hellenistic parapegma c. 15 C.E.: "A New Greek Calendar and festivals of the Sun," *JRS* 38 (1948 [Wise

and the moon in the text travels at 13° so if the moon on Nisan day 1 is assumed to be a lunar crescent at 0° Taurus, Wise has allowed 11° elongation from the sun from Creation for the lunar crescent to be observed; however, according to the text, as shall be shown, the moon moves at 13° per day, so the sun should be at 17° Aries). He concluded that *4QZodiac Calendar* must be a 364-day solar calendar, and he also observed that it was not clearly sectarian.[70] Wise focused on the possible late Hellenistic origin of the brontologion and did not consider the possibility that the zodiac calendar may have had a Mesopotamian origin, or that it may have descended from different roots to the thunder text.[71]

Wise's study was slightly antedated by Albani,[72] who had explored the Mesopotamian background of 4Q318 and had rejected the 364-day "Qumran calendar" as the basis of the zodiac calendar in the Dead Sea Scrolls.[73] Albani stated that the zodiac calendar was "most probably based on an ideal 360-day calendar attested in Babylonian and Hellenistic zodiacal astrology."[74] He did not suggest that it began at the lunar crescent. Greenfield and Sokoloff followed Albani's research on this subject and agreed that *4QZodiac Calendar* was a 360-day calendar that had its origins in Mesopotamia.[75]

Greenfield and Sokoloff, in their 1995 paper reproduced in the critical edition, further concluded that since 4Q318 was not a 364-day calendar, it was "non-sectarian in content." They maintained that scholars agreed that the group at Qumran did not produce texts in Aramaic, and that the community followed a calendar that presupposed 364 days. They claimed that Wise, whom they did not name,[76] had posited that the text was composed at Qumran:

> While some scholars have assumed that the text was composed by the Qumran community, this is far from clear. First, as has been pointed out by various scholars, essentially all the Aramaic compositions found at Qumran are non-sectarian in content. Hence, there is no reason to assume that this text would be the only exception. Secondly, there is a

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states 1940, which is an error]), 37–42 (at 38–39), see Wise, *Thunder in Gemini*, 40 n. 40. I return to this article in Chapter 2 for other reasons.

70 Wise, *Thunder in Gemini*, 48.

71 Wise, *Thunder in Gemini*, 21, 35–39.

72 Albani responds to Eisenman and Wise (1992) in his 1993 thesis, "Der Zodiakos," 20.

73 Albani, "Der Zodiakos," 3–22 (Table 1, 12b) (at 20–21); also later, Albani, *Astronomie und Schöpfungsglaube*, 83–87.

74 Albani, "Horoscopes in the Qumran Scrolls," 2.296–300 n. 58.

75 Greenfield and Sokoloff, and Pingree, DJD 36, 259–270; 270–274.

76 Albani is cited, and Wise, *Thunder in Gemini* is not.

> clear contradiction between the 360-day calendar of the text and the 364-day calendar of the community. Thus, like the other Aramaic compositions found at Qumran, this is also an example of a text in Standard Literary Aramaic, which survived there.[77]

This argument is circular in its reasoning and it misrepresents the views of Wise, who did not state where the text was composed. Albani contended in his later paper that 4Q318 did not contain any Jewish compositional factors:

> The astrological text 4Q318 is fully understandable within the framework of the Hellenistic zodiacal astrology with no specific Jewish or even Qumran elements. Therefore, the mere existence of this text in the Qumran library does not qualify as a "piece of evidence" for the acceptance or even the practical use of astrology at Qumran, just as finding of a "Prayer for the Welfare of King Jonathan and his Kingdom" (4Q448) at Qumran does not demonstrate a pro-Hasmonean attitude on the part of the Qumran Essenes.[78]

This statement appears to contradict Albani's other considerations on the possible use of 4Q318 by the leader of the Essene community[79] and his thesis elsewhere that 4Q318 (and the Ethiopic Astronomical Book of Enoch) are related to MUL.APIN.[80] If 4Q318 were unconnected with Second Temple groups, it would be the only text in Cave 4 to fall into that category. The hypothesis may illustrate the marginal status that this Aramaic scroll has held within the study of the calendars in the Dead Sea Scrolls, possibly because as an Aramaic text with an Mesopotamian background that resurfaced as a popular text in

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77 Greenfield and Sokoloff, DJD 36, 270; so with reference to the equivalence of Qumran Aramaic with Standard Literary Aramaic, J.C. Greenfield, "Aramaic and the Jews," in *Studia Aramaica* (ed. M.J. Geller et al.; JSSS 4. Oxford: Oxford University Press, 1995), 9; also see, S. Fassberg, "Salient Features of the Verbal System in the Aramaic Dead Sea," in *Aramaica Qumranica*, 65–78.

78 Albani, "Horoscopes in the Qumran Scrolls," 2.300. Ironically, in support of his thesis, he cited Wise's statement expressing doubts that the text was "sectarian" (Wise, *Thunder in Gemini*, 48), at 300 n. 70: "Even Wise has to admit at the end of his otherwise very instructive study: 'Apart from the solar calendar, nothing about this text is clearly 'sectarian.'" cf. above, Greenfield and Sokoloff's assertion that Wise, whom they did not name, had assumed that the text was sectarian. However, Wise did not claim that 4Q318 was not a Jewish composition; on the contrary, he tried to apply the predictions in the brontologion to Jewish historical events, as discussed in the next chapter.

79 Albani, "Horoscopes in the Qumran Scrolls," 2.322–323.

80 Albani, "Zodiakos," 27–35; Albani, *Astronomie und Schöpfungsglaube*, 83–87.

Byzantine circles and, as shall be shown, in late medieval Hebrew manuscripts, it is anything but easy to explain.

While the historical and geographical origins of 4Q318 were not discussed in depth in the critical edition most later scholars have generalised about the similarity of 4Q318 to Mesopotamian and Hellenistic texts overall. However, there is not a specific sense of its chronological development, its place of origin, a definition of its cultural origins (Mesopotamian Hellenism or Greek Hellenism), nor of the complicated routes of its textual transmission.

1.3 Background to the Micro-zodiac: The Zodiac and the Months

This section describes some of the Mesopotamian primary source material that may be reflected in *4QZodiac Calendar* in order to expand our knowledge on the possible background sources of 4Q318 that were not mentioned by Pingree, or by Greenfield and Sokoloff. Since Pingree made his observations, originally published in 1995,[81] there has been a significant growth in the field of Babylonian astronomy. Pingree pointed out that Tablet 44 of the canonical Akkadian celestial omen series *Enūma Anu Enlil*[82] [hereafter EAE] had not yet been published (*EAE* Tablets 44–49 were published in 2012).[83]

81 Pingree, Appendix 1, "Astronomical Considerations," in "An Astrological Text," 517–519, and repr in DJD 36, "318. 4QZodiology and Brontology ar," 270–273 (lead authors, Greenfield and Sokoloff).

82 The *EAE* comprises about 70 tablets and 7000 omina, mostly from the library of Ashurbanipal at Nineveh from c. seventh century B.C.E. The later copies date to the Neo-Babylonian period and the earliest, from the Old Babylonian period, eighteenth or seventeenth century B.C.E., see D. Brown, *Mesopotamian Astronomy-Astrology* (Groningen: Styx Publications, 2000), 107, 130–138; E. Reiner, "Babylonian Celestial Divination," in *Ancient Astronomy and Celestial Divination* (ed. N.M. Swerdlow; Cambridge, MA: The MIT Press, 2000), 22–23. Rochberg, *Heavenly Writing*, 2–4: the *EAE* was placed in the library at Nineveh and cited in correspondence between King Esarhaddon (680–669 B.C.E.) and Ashurbanipal (668–627 B.C.E.) and their learned advisors, eadem, 66–78.

The omina from natural phenomena in the *EAE*, including thunder, are contained in tablets 40 to 50; see Koch-Westenholz, *Mesopotamian Astrology*, 115, or tablets 37–49, see Reiner, "Babylonian Celestial Divination," 22–23.

Herman Hunger, *State Archives of Assyria* vol. 8 [SAA 8], contains primary source texts on celestial omens, including those from the *EAE* and protases of the moon and thunder, for example, SAA 8, no. 354; and protases of thunder in a named month, for example SAA 8, no. 33.

83 E. Gehlken, *Weather Omens of Enuma Anu Enlil: Thunderstorms, Wind and Rain* (Tablets 44–49). (CM 43; Leiden: Brill, 2012). Zodiacal omen texts are discussed in Chapter 2 in

Pingree concentrated his brief comments on the astronomical background to *4QZodiac Calendar* in relation to the Byzantine Greek texts that are analogous to *4QZodiac Calendar and Brontologion* (these are discussed in the next chapter). Since that time, a number of astrological-astronomical texts from Mesopotamia have been published that were written closer in time to *4QZodiac Calendar* and which share some similar elements with the Qumran zodiac calendar. Recent scholarship has encompassed some late Babylonian lunar zodiacal texts that feature the "micro-zodiac." This is an astronomical and astrological construct in which each of the whole signs of the zodiac are divided into a miniature zodiac: the 12 signs of the zodiac are subdivided into the 12 signs again, usually beginning with the sign that is being divided.[84] Although Pingree did not mention the micro-zodiac texts, they are related to 4Q318. Before examining these texts, we shall contextualise the concept of the zodiac itself in relation to *4QZodiac Calendar*.

The zodiac is the division of 12 constellations on the ecliptic into signs of equal lengths of 30°;[85] the creation of the zodiac from the constellations can be traced back to sometime during the mid-fifth century B.C.E. in Mesopotamia.[86] According to Rochberg, the zodiac was invented in the period of development of scientific mathematical astronomy, not for divination purposes, but for

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relation to *4QBrontologion*. (Tablets 44–49 do not, in fact, deal with the omina connected with the moon in the zodiac, as Pingree had thought).

84 See Section 1.3.1. Assyriological scholarship on the micro-zodiac includes: A. Sachs, "Babylonian Horoscopes," *JCS* 6 (1952): 65–75; O. Neugebauer and A. Sachs, "The Dodekatemoria in Babylonian Astrology," *AfO* 16: 65–66; F. Rochberg-Halton, "Elements of the Babylonian Contribution to Hellenistic Astrology," *JAOS* 108.1 (1988): 51–62 (esp. 57–60); E. Reiner, *Astral Magic in Babylonia* (Transactions of the American Philosophical Society 85.4; Philadephia: American Philosophical Society, 1995), 110; Hunger and Pingree, *Astral Sciences*, 29; Brack-Bernsen and Steele, "Babylonian Mathemagics," 95–121; F. Rochberg, "A Babylonian Rising-Times Scheme in Non-Tabular Astronomical Texts," in *Studies in the History of the Exact Sciences in Honour of David Pingree* (Leiden: Brill, 2004), 56–94; N.A. Roughton et al., "A Late Babylonian Normal and *Ziqpu* Star Text," *AHES* 58 (2004): 537–572; J.M. Steele, "Greek Influence on Babylonian Astronomy?" *MAA* 6.3 (2006): 153–160; Hunger, "How to Make the Gods Speak: A Late Babylonian Text Related to the Microzodiac," *AS* 27 (2007), 141–152.

85 Rochberg describes the zodiac as a belt of approximately 12° breadth, extending north and south of the ecliptic, the oblique circle which defines the apparent path of the sun through the stars in about one year [and the moon in about one month], see F. Rochberg-Halton, "New Evidence for the History of Astrology," *JNES* 43.2 (1984): 121 n. 23.

86 F. Rochberg, *Heavenly Writing*, 100, 130; J. Britton and C. Walker, "Astronomy and Astrology in Mesopotamia," in *Astronomy before the Telescope*, 49.

astronomical computation.[87] Van der Waerden argued that zodiac signs were meant to correspond with months because the unequal sizes of the constellations could not be calendrical.[88] Indeed, Rochberg shows that in the omen tablet, BM 36746, dated after 400 B.C.E., that is, the Late Babylonian period, the 12 zodiac signs have been substituted for the 12 months.[89] This system will be discussed later in this chapter. The micro-zodiac texts examined in the following sub-sections appear to stem from the Late Babylonian period. An examination of the variety of these tablets may help in the process of classifying and refining our knowledge of the background to 4Q318.

1.3.1 *TCL 6.14: A Handbook of Astrology*

Sachs was among the first to identify and name the "micro-zodiac."[90] His important text, TCL 6.14 (AO 6483),[91] a kind of education manual for teaching astrology is undated but it is known to be related to other late astronomical texts, that were mainly copied in Uruk during the Seleucid era (312–63 B.C.E.), and one in Babylon in the Seleucid, or the Arsacid period (247 B.C.E.–224 C.E.).[92] In TCL 6.14, the units of information are clearly demarcated in terms of content with horizontal lines drawn across sections of the tablet to separate the units of information.

The tablet begins with a description of the main waxing and waning phases of the moon's disc in the lunar month: Last Quarter, Dark Moon [conjunction], First Quarter, Full Moon, and Dark Moon (TCL 6.14 obv. 1–4).[93] There then follows an astrological formula, which states that the moon traverses each

87 Rochberg-Halton, "New Evidence for the History of Astrology," 121.

88 B.L. van der Waerden, "History of the Zodiac," *AfO* 16 (1952): 221; so Rochberg, *Heavenly Writing*, 132.

89 Rochberg-Halton, "New Evidence for the History of Astrology," 128–129, translation, 136–138.

90 Sachs, "Babylonian Horoscopes," 71.

91 Sachs, "Babylonian Horoscopes," 49–75, transcription of TCL 6.14: 65–67; translation, 67–70.

92 Sachs, "Babylonian Horoscopes," 72 n. 54. According to Gray, "almost all astronomy from the Later Babylonian Period originates from the city of Babylon," in *A Study of Babylonian Goal-Year Astronomy*, 16. Ephemerides used to ascertain the position of the moon are known from Uruk (232–152 B.C.E.) and Babylon (182–50 B.C.E.), see O. Neugebauer, *ACT*, 1.10.

93 Sachs, "Babylonian Horoscopes," translation, 67. Cf. the interest in proportions of the waxing and waning moon in 4Q208 Astronomical Enoch^{a}ar, frags 1–33 (Tigchelaar and García Martínez, DJD 36), 107–129; and 4Q208 Astronomical Enoch^{b}ar, frags 1–22 (Tigchelaar and García Martínez, DJD 36), 135–158.

of the 12 zodiac signs in 2½ days within a 30-day schematic lunar month (lines 7–13).[94]

The first sub-division of Aries is the micro-zodiac portion Aries, the next is Taurus (lines 8–9); the sub-divisions follow each other in the order of the signs of the zodiac, ending with Pisces (lines 9, 14–19).[95] Each sub-division of the zodiac sign corresponds to 2½ days within a 30-day schematic lunar month (line 10) which is an approximation of the time it takes for the moon to traverse one zodiac sign. The divinatory significance for the moon's position in each portion of the zodiac is then given. The prediction denotes how the subject of a horoscope would die and the overall quality of the life (TCL 6.14 obv. 22–25).[96] The forecast may be reckoned from the information given in the section above, but this is not explicitly stated.[97] The text is a possible step towards the composite form of a zodiac calendar accompanied by an omen text.

TCL 6 no 14 (AO 6483). Translation A. Sachs (1952):

(Beginning destroyed)
1) [. . . . . (On) the . . . . t]h day: half
of the lunar disc. (On) the [. . . th] day:
[. . . . . .]
2) [. . . . . .] (On) the 28th day, the
day-when-the-moon-disappears: the lun-
ar disc is not [visible].
3) [. . . . . .] (on) the 8th day: half of the
lunar disc. (On) the 16th day: the
lunar disc [. . .].
4) [(On) the . . . ?th day: half of the lunar] disc.
(On) the 28th day, the-day-when-the-
moon-disappears: the lunar disc is not
visib[le].
5) [(Scribal remark: . . . . . fingerbreadths], sur-
face left free on the tablet {which was
the source of this copy}.
6) To find [. . . . . .] a zodiacal sign: in
the . . . . . of stone, plant, and tree

94 Sachs, "Babylonian Horoscopes," translation, 67–68.
95 Sachs, "Babylonian Horoscopes," translation, 67–68.
96 Sachs, "Babylonian Horoscopes," translation, 68.
97 Sachs, "Babylonian Horoscopes," translation, 73.

7) [. . . . . .] portions in one zodiacal sign
of (?) the sun
8) [. . . . . .] zodiacal sign in one zodiacal
sign of (?) the moon. . . . .
9) [. . . . Aries . . .] from its beginning to its
end, as far as (?) Taurus.
10) [Thir]ty days correspond to one *bēru*
{= 30°}. You shall reckon 2½ days for
one portion (of the 12 portions), and
thus
11) the 12 . . . . . of the portion of Aries will
result (?) for you.
12) Multiply [2;] 30 (days) by 12—12 being
the. . . . of the portion of Aries and
(you will get) 30 (as the result).
13) [In 30] days, the twelve . . . . . of the portion of Aries will be complete.
14) First [portion]: its name is Aries. Second
portion: its name is Taurus.
15) [Thir]d portion: its name is Gemini.
Fourth portion: its name is Cancer.
16) [Fif]th portion: its name is Leo. Sixth
portion: its name is Virgo.
17) [Seven]th portion: its name is Libra.
Eighth portion: its name is Scorpius.
18) [Nin]th portion: its name is Sagittarius.
Tenth portion: its name is Capricorn.
19) Eleventh portion: its name is Aquarius.
Twelfth portion: its name is Pisces.
20) Total: 12 . . . . . of the portion of Aries, in the midst of which the sun and moon
pass by. I pointed (them) out to you.

In this scenario, lines 12–19 describe the path of the moon through the zodiac. After the moon's conjunction with the sun, the lunar month then begins with the first crescent. In the ideal scheme, the conjunction between the sun and the moon occurs in Aries and the first crescent of the moon, with which Month I begins, also occurs in Aries. With reference to the unit that details the "micro-zodiac" (TCL. 6.14. obv. 6–20), Sachs commented:

> One possibility—which, however, is not very likely—is that we are dealing with essentially nothing more than a crude schematic description of an astronomical phenomenon, namely, the motion of the moon through the zodiac. Specifically, the text might be saying that if one starts with a conjunction of sun and moon at the beginning of Aries, the moon will pass through the whole zodiac in the ensuing 30 days, remaining in each sign of the zodiac 2½ days, while the sun stays in Aries for the whole period of 30 days.[98]

As Sachs stated, the sun stays in Aries throughout the month, moving ideally at 1° per day, that is, taking 30 days to traverse one zodiac sign, all 12 of which are 30° wide, comprising the 360° zodiac. The moon, however, ideally moves about 1° every two hours. It takes, therefore, a day and a night, schematically, to move 13°, and less than 2½ days, to traverse one zodiac sign. In one ideal month of 30 days the moon has moved through all 12 zodiac signs (12 × 2½ = 30). The text presupposes a 360-day year, (corresponding to the number of degrees) (lines 10–13) consisting of 12 lunar months correlating to the zodiac signs, each composed of twelve 2½-day parts of the month/ signs of the zodiac, in the order in which they occur. There would be 144 such parts. There then follows predictions for each position of a zodiac sign within the micro-zodiac mainly for how the subject of a horoscope will die, and the overall quality of their lives:

> (*TCL 6 No. 14. Obv, 22–25*):
>
> 22) The place of Aries: death of his family.
> The place of Taurus: death in battle.
> The place of Gemini: death in prison.
> 23) The place of Cancer: death in the ocean; longevity. The place of Leo, he will grow old, he will be wealthy; secondly, the capture of his personal enemy.
> The place of Virgo: he will be wealthy; anger.
> 24) The place of Libra: good days; he will die
> (at the age of?) 40 (?) years (?). The
> place of Scorpius: death by rage (is?)
> his death by fate. The place of Sagit-
> tarius: death in the ocean.
> 25) The place of Capricorn: he will be poor,
> he will be hysterical (?), he will grow
> sick and die. The place of Aquarius:

98 Sachs, "Babylonian Horoscopes," translation, 71.

> (at the age of?) 40 (?) years (?), he will
> have (?) sons; death by water. The
> place of Pisces: (at the age of?) 40 (?)
> years (?), he will die; distant days. . . .

The prediction, possibly based on the sun, moon, a planet or a celestial event occurring in one of these places, would be deduced from the calculations given in the section above, but this is not explicitly stated. The remainder of the extant text (TCL 6.14 obv. 27–40, rev. 1–28) gives astrological predictions using an apodosis-protasis formula for genethliacal horoscopes ("If a child is born when. . . . [then his life? will be . . .]) when planets are rising, or stationary, for lunar and solar eclipses and when certain stars are rising, without any mention of the zodiac signs (TCL 6.14 rev. 29–38).

Sachs's alternative explanation for the text's formula was that "the intent" of TCL 6.14 lines 6–20 obv. was "astrological, not astronomical:"[99]

> The general purpose of this section would be to show how—for some astrological purpose that is obscure for the present—a sign of the zodiac is itself divided into twelve equal parts, forming a "micro-zodiac," to which are then assigned the identical names and sequence of the twelve zodiacal signs themselves.[100]

In this suggestion (hereafter, Option 1) he proposed that each of the 12 signs of the zodiac was sub-divided into 12 equal parts in the order of the zodiacal sequence. The first of these is the same as the whole sign and the last portion corresponded to the previous sign. Hence, the first sub-division of Aries is Aries, the second part of Aries is Taurus, ending in Pisces. In Taurus, the first sub-division is Taurus, the second, Gemini, ending in the 12th sub-division, Aries. The sequence would be as follows:

> *Aries*: Aries, Taurus, Gemini, Cancer, Leo, Virgo, Libra, Scorpio, Sagittarius, Capricorn, Aquarius, Pisces.
>
> *Taurus*: Taurus, Gemini, Cancer, Leo, Virgo, Libra, Scorpio, Sagittarius, Capricorn, Aquarius, Pisces, Aries.
>
> *Gemini*: Gemini, Cancer, Leo, Virgo, Libra, Scorpio, Sagittarius, Capricorn, Aquarius, Pisces, Aries, Taurus. And so on.

99 Sachs, "Babylonian Horoscopes," 71.

100 Sachs, "Babylonian Horoscopes," 71.

His observation echoes a similar description to the scheme reflected in *4QZodiac Calendar*. The connections and dissonances between the texts are that in TCL 6.14, as in *4QZodiac Calendar*, the sun stays in Aries throughout the first month, moving ideally at 1° per day, that is, taking 30 days to traverse that 30° zodiac sign. The moon moves through the 12 zodiac signs schematically spending 2½ days in each of the 12 signs every month (12 × 2½ =30). The text, TCL 6.14, describes an ideal sidereal month, that is, the moon completes its orbit around the earth in 360° with respect to a fixed star, moving through 12 signs of the zodiac, instead of 13, in a synodic month.[101] (A real sidereal month is 27.3 days, not 30 days as in this text).

In *4QZodiac Calendar* beginning with Nisan, the moon moves from Taurus, orbits through the rest of the zodiac and traverses Taurus again at the end of Nisan, completing 13 signs in 30 days. As stated, this is a synodic month, meaning the moon returns to the same phase a month later.[102] Instead of taking 2½ days per micro-sign, as in TCL 6.14, the mathematical arrangement in *4QZodiac Calendar* allows the moon to take a schematic arrangement of 2 and 3 days to complete each sign in sequence (see Table 1.1.3). An ideal 360-day year is presupposed in both texts.

Sachs further suggested that the micro-zodiac might be connected to the Babylonian "dodekatemoria" system, a method of astrological computation using the 12 zodiacal sub-divisions of each zodiac sign (hereafter Option 2).[103] The formula in the text (TCL 6.14, lines 10–13 obv.) may be reflected in the

101 Rochberg, *Heavenly Writing*, 132: The Babylonian zodiac was sidereally fixed, so that one year was defined by the time that the sun returned to the same position with respect to a fixed star. For definition, see also *Astronomy before the Telescope*, 344; Koch-Westenholz, *Mesopotamian Astrology*, 31. A non-schematic sidereal month is about 27.32 days (27 days 7 hours 43 minutes 12 seconds), here the month is 30 days, as stated.

102 See *Astronomy before the Telescope*, 345; Koch-Westenholz, *Mesopotamian Astrology*, 31. The mean synodic month is 29.53 days (29 days 12 hours 44 minutes 2.8 seconds); also Albani, *Astronomie und Schöpfungsglaube*, 82.

103 Sachs, "Babylonian Horoscopes," 72–73. See also O. Neugebauer and A. Sachs, "The Dodekatemoria in Babylonian Astrology," *AfO* 16 (1952–3): 65–66. In the texts MLC 1886 and 1859 first published by A.T. Clay in *BRM* [*Babylonian Records in the Library of Pierpont Morgan*] IV, 19:10 and 20:21 (New Haven, 1923) and later by A. Ungnad, "Besprechungskunst und Astrologie in Babylonien," *AfO* 14 (1944): 251–284, the moon's degree may be multiplied by 12 and the sum is added to that position to compute another degree in the zodiac. (In an alternative method, suggested by Sachs, the total could be added to 0° degrees of the sign, as in Greek astrology). *BRM* IV 19, 20 are partly published in Koch-Westenholz, *Mesopotamian Astrology*, 168–169; Reiner, *Astral Magic*, 108–111; Rochberg-Halton, "Elements of the Babylonian Contribution to Hellenistic Astrology," *Journal of the American Oriental Society*, 108.1 (1988), 58; Hunger and Pingree, *Astral Sciences*, 29.

systems of reckoning the Hellenistic dodekatemoria, described by the Roman astrologer and poet, Manilius:[104]

> Now shall I recount what dodecatemory belongs to each sign and in what order they are to be found, lest you go astray and err because you know not the divisions of the signs. Within their own domain the constellations keep the first division for themselves, the next is bestowed upon the sign following, and the remaining signs according to their place in the sequence are allotted successive divisions, and the last assignment is made to the farthest sign away. Thus each sign occupies in every constellation two and half of its degrees, making a total of thirty degrees exacted from the whole zodiac.[105]

Thus, each of the 12 signs comprises 30 degrees, and the sub-divisions in the micro-zodiac are 2½° but unlike the first option, the 144 parts of the micro-zodiac (12 signs × 12 sub-divisions) were connected to the Babylonian "dodekatemoria" system. This would be a method, Sachs suggested, by which the moon's degree was multiplied by 12 and the result added to the original position, or to 0° of the original sign,[106] similar to the "dodekatemoria" method in later Hellenistic astrology.[107] He concluded that the formula in Mesopotamian astrology (TCL 6 14 Obv. lines 10–13) is comparable to the systems of reckoning in the Hellenistic dodekatemoria, cited above.[108]

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104 Manilius, *Astronomica* 2.713–749 (Goold, LCL). The Babylonian systems do not include the additional 30 degrees, as per the formula of Manilius in Greco-Roman astrology, but describe slightly different formulae, see below.

105 Manilius, *Astronomica* 2.713–721 (Goold, LCL).

106 Sachs, "Babylonian Horoscopes," 71–73.

107 A. Bouché-Leclercq, *L'Astrologie Grecque* (Paris:E. Leroux, 1899), 216 n. 3, 299 n. 1–304; Manilius, *Astronomica* 2.687–749.

108 Manilius (*Astronomica* 2.713–749 {Goold, LCL}), op. cit., describes the following rules: Multiply the number of the moon's degree (the longitude) by 12, and add 30° degrees to reckon the position in the 360° zodiac. That place and three other positions at 90° intervals from that point are the moon's dodekatemoria. Manilius states that each 2½° part should be further divided into five parts (that is, 30 seconds each, equivalent to half-a-day of the moon's course in temporal terms). The position of a planet occurring in any one of the four parts should be astrologically interpreted according to each of the corresponding positions in the zodiac: "From all quarters must be pierced together the design by which all things are ordered."

Finally, Sachs thought that the TCL 6.14 obv. line 6 (broken), where zodiac signs are attributed to plants, stones and trees, may have referred to "the specific astrological purpose for which sub-dividing the micro-zodiac is valid."[109]

It is unlikely that 4Q318 could be used for ascribing zodiac signs to plants, stones and trees because no such list is contained in the Qumran scroll. It is true that *4QZodiacal Physiognomy* possibly associates a "hard stone" or "granite" אבן צונם (4Q186 frag 1 col. ii line 2) with a zodiac sign; if so, the "hard stone" may be connected with the zodiac sign of Taurus שור (4Q186 frag 1 col. ii line 9) within the astrological handbook or compendium of 4Q186.[110] What emerges from Sachs's text is that the calendrical, or astronomical, section (TCL 6.14 obv. 9–20) may serve the astrological components, as is the case in 4Q318. Texts related to TCL 6.14 are examined next.

1.3.2 *The Names of the Micro-zodiac Sub-Divisions*

Recent publications of very different late Babylonian astrological-astronomical texts have shed further light on the relationship between the micro-zodiac and the months.[111] Rochberg and others have shown that in some late Babylonian astronomical-astrological texts each one of the twelve 2½° parts of each of the 12 zodiac signs in the Mesopotamian micro-zodiac has a double name. In this way the 144 sub-divisions may be identified by their position in the zodiac with respect to the sign and, by association, its cognate month. The names also apply to the part that is arrived at after the arithmetical astrological formula of dodekatemoria has been applied, as described in the previous section (so, Option 1 and Option 2).[112]

Taking Option 1 only, the first component of the name of the 2½° sub-division of a whole zodiac sign is the name of the sign occupied by the sun all month; the second part of the name is the sign traversed by the moon. Hence, the first portion: 2½° or 2½ days, of the whole sign of Aries and its corresponding month, Nisannu (Month 1) is named "Aries of Aries." The second portion of

109 Sachs, "Babylonian Horoscopes," 72 (translation, 67).

110 J. Allegro, "186." *Qumran Cave 4* (*4Q185–4Q186*), DJD 5 (Oxford: Clarendon, 1968), 88–90; M. Popović, *Reading the Human Body* (STDJ 67; Leiden: Brill, 2007), 29, 51–54, 237.

111 Hunger, "How To Make the Gods Speak," 145–146; Hunger and Pingree, *Astral Sciences*, 29; Rochberg, "A Babylonian Rising Times Scheme," 79; Rochberg, "Elements of the Babylonian Contribution to Hellenistic Astrology," 57–60; Brack-Bernsen and Hunger, "The Babylonian Zodiac," 288.

112 Koch-Westenholz, *Mesopotamian Astrology*, 168–169; Rochberg-Halton, "Elements," 57–59; Reiner, *Astral Magic*, 110.

the whole sign is "Aries of Taurus," the third part of the sign is "Aries of Gemini," until the twelfth part, the last 2½° or 2½ days of Aries is called "Aries of Pisces." Similarly, the first sub-division of the next whole sign, Taurus, corresponding with Simanu (Month II), is "Taurus of Taurus," the next part is named "Taurus of Gemini," ending with "Taurus of Aries," and so on, around the zodiac in the order of the signs. The texts which name the sub-divisions also do so according to a 360°, or sidereal, lunar orbit

The micro-zodiac was also used to compute the 2½° parts of the zodiac signs, which rose at the same time as particular key stars, the *ziqpu* stars, culminated overhead, as well as other astronomical occurrences.[113] The late Babylonian astronomical texts (A 3427, LBAT 1499 and LBAT 1503) are possibly the only cuneiform sources published to date containing the actual values of the rising times of the zodiac.[114]

Another text, BM 33535, published by Hunger,[115] appears to use the micro-zodiac for both astronomical and calendrical computation, and for astrological purposes, such as medical treatments, plants, stones and cities. In this ritual text, the micro-zodiac appears in connection with the months and, importantly from the calendrical perspective, feast days. Two consecutive months, Simanu and Du'uzu (Month III and Month IV) in corresponding paragraphs on the obverse and reverse are ascribed 30 days each (obv. 7; rev. 7), suggesting an ideal 360-day year. The month Simanu (Sivan) corresponds to Gemini, and Du'uzu (Tammuz) is cognate with Cancer. Within the sub-sections, it is stated: "Gemini of Sagittarius. Lagaš. . . . Gemini of Sagittarius: (feast day) of the city god. The twins [?] Sin and Šamaš. Nergal. Feast of Ninurta" (obv. 1, 5, 6), and in the corresponding paragraphs on the reverse: "Cancer of Sagittarius. Mutabal . . . Cancer of Sagittarius: (feast) day of the city god, Šamaš, judge of the land . . ." (rev. 1, 5).

If a feast-day were to be held on the same day annually, the micro-zodiac should function calendrically in a luni-solar calendar so that the moon would reach the same zodiacal position each year. This means that some kind of intercalation is likely to have taken place. By including feast-days, BM 33535 roots its micro-zodiac into a seasonal zodiac calendar. Next, I shall survey research that discusses further Babylonian texts where the micro-zodiac is represented.

113 Rochberg, "A Babylonian Rising-Times Scheme," 57–94 (esp. 65, 79); Roughton et al., "A Late Babylonian Normal and Ziqpu Star Text," 537–572 (541–542); Brack-Bernsen, "The Path of the Moon," 16–31 (esp. 26).

114 Rochberg, "Rising Times," 57–94 (58); Rochberg, "Elements," 58–59.

115 Hunger, "How To Make the Gods Speak," 141–152.

1.3.3 *The* Gestirn-Darstellungen *Texts*

The corpus known as the "Gestirn-Darstellungen" tablets[116] is relevant to *4QZodiac Calendar* in that they contain the micro-zodiac with month names for the purpose of reading lunar eclipse omens. The corpus is also interested in the names of towns, temples, trees, plants, minerals and stones for each sign of the zodiac; the corpus is comprehensive and covers different generic astrological forms, whereas the text found at Qumran is genre specific. The published tablets were written in late third and early second century B.C.E. Seleucid Uruk[117] and represent less than half of a series of approximately 10, or fewer, tablets. Some texts align months with corresponding zodiac signs and contain omina forecasting the fate of king and country for the ancient kingdoms of Elam, Akkad, Subartu and Amurru, each of which is associated with a group of three signs and months. The Neo-Assyrian compendium of omens, *Enūma Anu Enlil*, assigns these four places to the quadrants of the moon (Akkad is cognate with Babylonia, Subartu with Assyria, Amurru with any country in the west, and Elam's name remained the same for more than 1,000 years)—the first quadrant to be darkened in a lunar eclipse meant that the country associated with that lunar quarter would suffer the prediction concerned.[118]

Two sets of tablets, VAT 7851 obv. (Text 1a) and VAT 7847+AO 6448 obv. and rev. (Text 2a [obv.] and Text 2b [rev.]), contain iconographical representations of heavenly bodies and constellations (including Hydra and the Pleiades), from which the series obtains its title, as well as columns consisting of the micro-zodiac.[119] The tablets are chronologically nearer to 4Q318 than to the various c. seventh century B.C.E. Mesopotamian omen series. The nature of the differences between the earlier and later omina are complicated because the later texts faithfully copied earlier material, in addition to developing innovative scholarship. Weidner compared the omina to material from the seventh century B.C.E. tablet, K. 11151, apparently from Assurbanipal's library. This comparison has been accepted by Caplice,[120] but disputed by Biggs who argues that K.11151 is a miscatalogued Seleucid text.[121] The disagreement itself illustrates the point that ancient scholarship was preserved for many centuries.

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116 Weidner, *Gestirn-Darstellungen*, 3–52, pls. 1–16 *'Tetrabiblos'*.

117 Weidner, *Gestirn-Darstellungen*, 5, and colophons by scribal families on texts: 9, 15, 33–4, 44, 47: VAT 7815 14–15r dated: Uruk, 14 Tebet, year 120 of King Antiochus [this date may have astronomical and divinatory or magical significance: full moon in Tebet, year 120 is one-third of 360].

118 Hunger and Pingree, *Astral Sciences*, 15–16. Cf. Ptolemy, Tetrabiblos (Robbins, LCL) II.3.

119 Weidner, *Gestirn-Darstellungen*, 15–34.

120 R. Caplice, review of E. Weidner, *Gestirn-Darstellungen, OrNS* 38 (1969): 580–582.

121 R.D. Biggs, review of E. Weidner, *Gestirn-Darstellungen, JNES* 30.1 (1971): 73–74.

Sachs suggested that the micro-zodiac in VAT 7847+AO 6448, obv. and rev., (Text 2a and Text 2b) and the "Gestirn Darstellungen" corpus (then all unpublished, but known) were related to TCL 6.14 obv. 6–20 because the arrangement of the zodiac signs was the same.[122] He thought that the purpose of the then-unpublished tablets had "nothing to do with horoscopic astrology as such."[123] VAT 7851 obverse (Text 1a), in Berlin's Vorderasiatisches Museum contains explicit correspondences between the 12 months and the 12 signs of the zodiac. It has an incised drawing of an image known as the "Babylonian Man in the Moon" and seven stars representing the Pleiades and "the bull of heaven," which roughly encompasses the zodiacal constellation of Taurus.[124] Beneath the constellational iconography are the remains of broken columns of text with

122 Sachs, "Babylonian Horoscopes," 72 n. 54.

123 Sachs, "Babylonian Horoscopes," 72.

124 Weidner, *Gestirn-Darstellungen*, 5–9, 12–13. Plates 1 (photograph) and 2 (line drawing). Paul-Alain Beaulieu, "The Babylonian Man in the Moon," *JCS* 51 (1999): 91–99 (esp. 91 n. 2). The figure appears to be holding a long, curved creature upside down, the shape resembles a waxing lunar crescent; he holds a horned club in his right hand in a smiting posture. On the right of the motif is a drawing of the bull of heaven and on the left of the tablet is a diagram of seven stars, presumed to be the Pleiades. The incised drawing is considered to be both an imaginary representation of the moon's surface and "allegorical representation of a lunar eclipse." (Beaulieu, "Babylonian Man in the Moon," 91–92). A similar but earlier tablet, KAR 307, from Neo-Assyrian Assur, describes the cosmic measurements of the sun and moon, a statement that Marduk is inside the sun, Nabû is inside the moon, and a hand holding a dagger above the lion. The description visually matches the drawing in the later tablet and involves the theme of solar and lunar measurements. KAR 307. rev. 4–6: "Forty leagues is the circumference of the sun. Sixty leagues is the circumference of the moon. That which is inside of the s[un is Mar]duk. That which is inside of the moon is Nabû. Inside the sun there is a viper, [his]... Inside the m[oon] is its [mot]her (?). The dagger above the lion is of the hand [of...]," Beaulieu, "Babylonian Man in the Moon," 93–95; A. Livingstone, *Mystical and Mythological Explanatory Works of Assyrian and Babylonian Scholars* (Oxford: Clarendon, 1986), 82–85; idem, *Court Poetry and Literary Miscellanea* (SAA 3; Helsinki: Helsinki University, 1989), 99–102.

The astrological tablet from Seleucid Uruk, VAT 7847 (Text 2a) (Weidner, *Gestirn-Darstellungen*, pls. 5, 6 belongs with AO 6448 (Text 2b) which is in Paris; VAT 7847 is in Berlin) is related to VAT 7851 the eponymous Babylonian Man in the Moon tablet (Text 1a) but does not join it. It is inscribed with pictorial representations of Leo, Hydra and Marduk. It bears a similar text on the measurements of the circumference of the sun and moon to KAR 307. VAT 7847 (Text 2a) obv.12: "$3^1/^3 \times 15$ (=) 50 (leagues) is the circumference of the sun. These are the (measurements of) the circumference(s) of the moon and sun" (Beaulieu, "Babylonian Man in the Moon," 95). The texts are among a number of Mesopotamian tablets observed by Beaulieu to describe a god or a beast in the moon combined with the comparative measurements of the sun and moon. (Beaulieu, "Babylonian Man in the Moon," see Table 1, 98, for a synopsis of seven cuneiform sources).

the list of the 12 zodiac signs in sequence, beginning with Taurus, reflecting the subject of the drawing. Weidner compares this table to the micro-zodiac described by Sachs.[125]

The omen written across the top of the drawing on Babylonian Man in the Moon has a protasis for a lunar eclipse in the month of *Airu* (Ajaru/ Iyyar) (Month II), the luni-solar month corresponding to Taurus, therefore also appropriate to the image; a lunar eclipse in this month affects Elam.[126] The apodosis for Text 1a,[127] VAT 7851 obv., following the astrological protasis,[128] is:

> Text 1a. VAT 7851 obverse:
> 2 . . . . . Ruin of Elam. Elam will become ruined, its land will be plundered, the king of Elam [will fall through the weapon, to . . .] 3. he will not comeback, the son of a nobody will be raised up and will take possession of the throne of Elam.[129]

Weidner states that the writer used a *Vorlage* in poor condition from the Old Babylonian lunar eclipse omen Tablet 19 of the EAE in which Months II, VI, and X are associated with Elam.[130] However, Rochberg argues that this information

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A unifying factor between the cuneiform sources of KAR 307 and VAT 7847 is that the sun and the moon are of similar, but not of equal size.

125 Weidner, *Gestirn-Darstellungen*, 13, citing A.J. Sachs, "Babylonian Horoscopes," 71.

126 Weidner, *Gestirn-Darstellungen*, 12–13; Hunger and Pingree, *Astral Sciences*, 15–18; *EAE* tablets 15–22 are concerned with lunar eclipse omens, see Rochberg, *Heavenly Writing*, 66–72, 77–78; F. Rochberg-Halton, *Aspects of Celestial Divination: Lunar Eclipse Tablets of EAE*, 37, 67–272, 160 nn. 22, 23 (BM 36746+); Rochberg, "Lunar Data in Babylonian Horoscopes," *Centaurus* 45 (2003): 36–37; P-A Beaulieu, "The Babylonian Man in the Moon," JCS 51 (1991): 91–99.

127 Weidner refers to this text as Text 1, and includes the reverse. To distinguish between the obv., and rev. I have labelled the obv., Text 1a.

128 The conditions represented in the protasis, aside from a lunar eclipse in the month of Airu in the middle of the night watch, is the blowing of the south wind, the non-eclipse of Venus (visibility?), Saturn [broken] and the eclipse of Jupiter (non-visibility?), see VAT 7851 (Text 1a), lines 1–2, Weidner, *Gestirn-Darstellungen*, 12. My translation from the German.

129 Translation from German by this author. Weidner, *Gestirn-Darstellungen*, 12. "The son of a nobody," is a phrase known from the Assyrian King List and means a man not of royal descent, see H. Lewy, "Assyria c.2600–1816 B.C.: King List and Chronology," *The Cambridge Ancient History*, vol. 1, pt. 2. *Early History of the Middle East* (ed. I.E.S. Edwards et al.; Cambridge: Cambridge University Press, 1971), 749.

130 Weidner, *Gestirn-Darstellungen*, 13; Months II, VI and X are cognate with Taurus, Virgo, and Capricorn, the 2nd, 6th and 10th signs.

is available in a later text.[131] More recently, Rochberg has found a similar correspondence between Virgo and Elam [unpublished tablet, broken].[132] The prognostication is based on the month in which the eclipse occurs (Month II: Taurus, the second sign of the zodiac and in trine with Virgo {for 'trine' see n. 131, below}), not the position of the moon (a lunar eclipse occurs at full moon, which is in the opposite sign to the sun, so the full moon in Month II at eclipse would be in Scorpio, cognate with Month VIII and Subartu, see nn. 131 and 141).

In another "Gestirn Darstellungen" text VAT 7847 + AO 6448 obv. (Text 2a): carries the constellational images of Leo, a lion, on the back of Hydra, a sea-serpent, and the planet Jupiter. A long omen is inscribed horizontally above the illustrations. The horizontal omen on Text 2a begins with a very specific astrological-astronomical protasis for a lunar eclipse in the month of Ab.[133] The month of Ab (Month V) corresponds to Leo. At the lunar eclipse the full moon would be in the opposite sign of Aquarius, which is cognate with Month XI, representing Amurru, not Akkad.

> Text 2a: VAT 7847 + AO 6448 obv. (apodosis):
> 2. . . . then this becomes an omen for the King of Akkad who will experience a powerful siege; it will seize him and [. . .] 3. [Ruin for Akkad]. Akkad will be ruined; its pastures will be laid waste; its inhabitants will experience a powerful hunger; the brother will cut down his brother, the

131 Rochberg, *Lunar Eclipse Tablets*, 160 nn. 22, 23 (BM 36746+) and idem, "New Evidence for the History of Astrology," *JNES* 43.2 (1984): 115–140, 128–129, n. 50: Months I, III, V: Akkad; Months II, VI, X: Elam; Months III, VII, XI, Amurru; Months IV, VIII, XII: Subartu and Gutium. The 120° geometrical aspect is known as a trine in Babylonian and Hellenistic astrology.

132 BM 47494: 8–12: Rochberg, *Heavenly Writing*, 108–109. The extract she publishes is: "If Virgo: Elam . . . / If Scorpius: Dilmun and . . . / If Sagittarius: Babylon and Marad . . . / If Capricorn: Subartu . . ." The zodiacal signs arranged in order of their triplicities (also known from later Hellenistic astrology) also represent regions of significance, in idem, BM 47494 rev. 17–22: Taurus, Virgo and Capricorn are significant for Elam; Gemini, Libra and Aquarius are significant for Amurru; Cancer, Scorpius and Pisces are significant for Subartu, see, 109 nn. 45, 46. Also, F. Rochberg, "Lunar Data in Babylonian Horoscopes," *Centaurus* 45 (2003), 36–37, op. cit.

133 The conditions for the omen prediction include: the completion of the night-watch, the blowing of the north wind, the non-eclipse (visibility?) of Jupiter, Saturn or Mars in Aries, or (. . .) in Pisces, and if the eclipsed moon is surrounded by a halo and Regulus stands in it, then . . . (Translated from the German by this author), Text 2a, lines 1–2; Weidner, *Gestirn-Darstellungen*, 15.

> friend will cut down his friend with the weapon; for 200 years, upon the throne of Akkad will be [...] 4. [...] will become ...; the gods will desert the bodies of the land; or else: for the inhabitants, they will be dispersed; the inhabitants will abandon their abode of the gods; pity and salvation will completely come to an end; Enlil will bring down evil on the land, Akkad [...][134]

Running vertically beneath the images are columns of the micro-zodiac, a register divided into twelfths listing signs in their sequential order beginning with Leo (the fifth zodiac sign) and ending in Cancer (the fourth zodiac sign).[135] On the reverse of the joined tablets, VAT 7847 + AO 6448 rev. (Text 2b) is the tail of Hydra with Corvus standing on its tip, opposite a Hellenistic representation of Virgo, a profile of a woman holding a plant.[136] A broken omen—the protasis is badly damaged—is inscribed above the images and a micro-zodiac, commencing with the zodiac sign of Virgo and ending in Leo, is written in columns beneath the pictorial representations.[137] The omen relates to a lunar eclipse in the month of Elul (Month VI, corresponding to Virgo, and which is represented by the image of Virgo) and its interpretation:

> Text 2b: VAT 7847 + AO 6448 reverse: 2.... eclipse: Ruin of Ela[m, ...] 3. the brother will kill his brother, the friend will kill his friend with the weapon; the King of Akkad will be raised up and the King of Elam with the weapon....., Elam [...] 4. the inhabitants of Elam will experience a hard famine. For the King of Akkad and his subjects: [salvation and prosperity ...][138]

Hence, the columns of Texts 2a and 2b containing the micro-zodiac begin with the zodiac name of the corresponding constellation represented by the drawing above them. Similarly, Text 3a: BM 34572 obv., Sivan [Month III] corresponds to Gemini [the third zodiac sign] and relates to Amurru;[139] and in Text

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134 Weidner, *Gestirn-Darstellungen*, 15–16. Translated from the German by this author.

135 Weidner, *Gestirn-Darstellungen*, 9, 15–17, plates, 5, 6, 9; Brack-Bernsen and Steele, "Babylonian Mathemagics," 103–104; Rochberg, "Elements," 58.

136 Discussed in 1.5: The zodiac sign-names in 4Q318.

137 Weidner, *Gestirn-Darstellungen*, 9–10; 29–34, plate 10.

138 Weidner, *Gestirn-Darstellungen*, 29; cf. Rochberg, *Lunar Eclipse Tablets*, 209, *EAE* 20, Composite text X line 7; 124, *EAE* 17, G 17.

139 Weidner, *Gestirn-Darstellungen*, 34–38.

3b: BM 34572 rev.,[140] Tammuz [Month IV] corresponds to Cancer [the fourth zodiac sign] and the kingdom of Subartu.[141]

As with TCL 6.14, the divisions in the "Gestirn Darstellungen" texts comprise a sidereal month (the moon's return to the same fixed star).[142] This type of zodiac calendar is different to that of *4QZodiac Calendar*, although the generic system of dividing a month and corresponding signs into zodiacal units in their order, beginning with the sign related to the cognate month, is similar to the schematic structure of *4QZodiac Calendar*.

Another structural variation between the "Gestirn Darstellungen" corpus and 4Q318 is that *4QBrontologion* corresponds with the first zodiac sign of the moon in *4QZodiac Calendar*. Hence, *4QBrontologion* commences with thunder in Taurus echoing *4QZodiac Calendar* beginning with the moon in Taurus. By contrast, in the "Gestirn Darstellungen" texts, the omen is related to the zodiac sign of the sun, which corresponds to the first zodiac sign in the micro-zodiac of the month. Although the omen relates to the lunar eclipse of the month, the zodiac sign of the eclipsed full moon is not stated.

The omen predictions in the "Gestirn Darstellungen" corpus may seem to be relevant for the sign of the month in which the lunar eclipse occurs, whereas the predictions in the Qumran brontologion may be applied for the sign of the moon in which thunder occurs; however, when we explore other brontologia we will find that there is tradition to read the omen prediction at the first thunder in the year, and that the forecast applies for the year ahead (rather than for every time there is thunder).

The apodoses of the omina that run horizontally across the top of the tablets Text 1a VAT 7851 obv., and Texts 2a and 2b VAT 7847 + AO 6448 obv. and rev., variously contain the themes that are found in earlier Mesopotamian texts. The motifs of famine and the overthrow of a king with a weapon are generic themes, appearing in different omens and do not seem to be applied specifically to one sign. The zodiac signs correlating to the month in which the eclipse of the moon occurs indicate the name of the kingdom, the inhabitants and, therefore, their king who will be affected by the prediction. In 4Q318, the apodoses in 4Q318 viii 7–8: ruin for a region, a weapon in the king's court,

140 Published in T.G. Pinches, *Late Babylonian Astronomical and Related Texts* (Providence, RI: Brown University Press, 1955), no. 1580.

141 Weidner, *Gestirn-Darstellungen*, 36–37.

142 If the text described a synodic month (the interval between consecutive conjunctions), the column beneath Leo would begin and end in Leo, not begin in Leo and finish in Cancer. See Neugebauer, *HAMA*, 1084; idem, *Exact Sciences*, 192–193; Koch-Westenholz, *Mesopotamian Astrology*, 31.

and famine for the Arabs who will plunder each other, are the prognosis for the moon's position in Taurus. No country is named and the prediction for the moon in Gemini is different.

As shall be shown in the next chapter, some brontologia attested in Greek Byzantine manuscripts also assign the sun or moon's position in the zodiac to a particular country's inhabitants, sometimes a named country, and a specific prediction. This zodiacal system may have implications for the significance of 4Q318 col. viii lines 6–8, the prediction for thunder when the moon is in Taurus; specifically, the forecast in 4Q318 col. viii line 8—where hunger, or famine, כפן, is predicted for *the Arabs*, ערביא, who will also *plunder each other* אלן בא[לן בזזין]—may suggest that Taurus is the ruler of Arabia.

If the system of zodiacal geography in late Mesopotamian omens surveyed above (and in the next chapter in the Byzantine thunder omens) is applied to 4Q318 col. viii line 8, it is possible that the moon in Taurus in our text affects the Arabs. This insight is new and posits that 4Q318 may be employing a system of zodiacal geography similar to that attested in the "Gestirn Darstellungen" corpus. Zodiacal geography is also evident in Greco-Roman astrology, by which countries and their inhabitants are ruled by a zodiac sign and have the characteristics and personalities attributed to features of the planet 'ruling' that sign.[143] Interestingly, there is a link here with the contemporaneous Roman poet-astrologer Manilius' *Astronomica*: he writes that Taurus is the astrological ruler of Arabia: Scythia, Asia "and the unmanly Arabs," *Taurus habet . . . et mollis Arabas*.[144] Taurus is ruled by Venus and it is a feminine planet, the mythological goddess of love;[145] accordingly, Manilius lists feminized and unmanly qualities of men born under its influence.[146] The link here with Manilius may be more than coincidental, constituting probable evidence of the transmission

143 See Manilius, *Astronomica* 4.744–817 (Goold, LCL) for all the countries and cities ruled by the 12 signs and the characteristics of the their people according to planets associated with the countries' signs, and summary in the Introduction, xci. Manilius flourished in the early first century C.E., and wrote *Astronomica* probably under Augustus or Tiberius (K. Volk, *Manilius and his Intellectual Background* [Oxford: Oxford University Press, 2009], 4); his references to "Caesar" and "emperor" in his epic poem can apply historically and astrologically to either or both rulers (*Astronomica* [Goold, LCL], p. 3; Book 1.7, note *b*, p. 5; Book 4.764, p. 297 note *b*, Book 4.776–779, p. 284 note *b*). Ptolemy's zodiacal geography in *Tetrabiblos* II.1–5 (Robbins, LCL).

144 Manilius, *Astronomica* 4.754 (Goold, LCL); at 4.654 Manilius uses the phrase "mollis Arabas terramque" (the land of the unmanly Arabs).

145 Manilius, *Astronomica* 2.439 (Goold, LCL).

146 Manilius, *Astronomica* 5.140–156 (Goold, LCL).

of 4Q318 between Aramaic and Hebrew sources to the Greco-Roman world which would have Hellenised the ideas, discussed now further.

Thus, the reason for Arabs to be included in *4QBrontologion* is possibly because according to the zodiacal geography of 4Q318, Taurus governs Arabia and Arabs (although there is no obvious connection). In the Byzantine brontologia, explored in the next chapter, each zodiac sign mentions a particular nation who is governed by that sign. It may be reasonable to conjecture, based on this tradition history that this is the pattern in 4Q318. Pingree warns that in the absence of an Akkadian original the direction of transmission: Aramaic to Greco-Roman, or the other way around can only be speculative.[147] However, if we examine Manilius specifically, a case can be made here that the reception was in the direction of Aramaic to Latin. It is possible that Manilius's zodiacal geography contains transmitted elements of zodiacal geography originally from Mesopotamia because in his list of signs that rule specific cities and countries Pisces rules Babylon, Susa and Nineveh.[148] Nineveh, had not only long ceased to exist when Manilius flourished, but the association of Nineveh with Pisces is an Aramaic pun with fish and Pisces in Aramaic נוניא, evidenced, in *4QZodiac Calendar*,[149] the earliest known Aramaic translation of Pisces, or the translated Hebrew name of city itself נִינְוֵה, Nineveh, which carries the same double-meaning, taking the Aramaic etymology into account.[150] A cuneiform ideogram of Nineveh (*nūnu* in Akkadian) is a fish inside an enclosure, an allusion to the river goddess Ninâ.[151] Furthermore, Manilius references the etymology of Babylon (which he also assigned to Pisces) in terms of its Hebrew pun, Babel בבל.[152] He seemingly connected the name with its etymological verb 'to confuse' or 'confound' with reference to the profusion of languages in the biblical story of the tower of Babel, Gen 11, by adding to the list of 'Piscean' cities of Babylon, Susa and Nineveh "places where names could scarce be conveyed by countless turns of speech."[153] According to Goold, Manilius's Pisces is based

147 Pingree, "Astronomical Aspects," in Greenfield and Sokoloff, "4Q318," DJD 36, 272.

148 Manilius, *Astronomica* 4.804 (Goold, LCL).

149 4Q318 frag 2. col. vii line 4 (recon); line 9; col. viii line 5 (recon).

150 BDB, s.v. 644.

151 C.T. Fritsch, "Nineveh," *ISBE* 3:538; for a cuneiform symbol of "fish," see C.B.F. Walker, *Reading the Past: Cuneiform* (London: British Museum Press, 2000), 10; for a cuneiform symbol of "Nineveh," see L.W. King, *Catalogue of the Cuneiform Tablets in the Kouyunjik Collection of the British Museum. Supplement* (London: Trustees of the British Museum, 1914), 251 (second symbol).

152 BDB, s.v. 93.

153 Manilius, *Astronomica* 4.805 (Goold, LCL). Goold adds in a note, "because the native names are so exotic," 287, note i, apparently unaware of Manilius's linguistic puns.

on Babylonian astronomy of the fishes facing different directions; the Roman myth partly alluded to by Manilius (see note) reflects the Babylonian concept of Pisces and so he may have been describing a Latinised Mesopotamian version of the origin of the iconography of the zodiac sign.[154]

It is possible that Taurus ruling the Arabs passed from Aramaic astrology to Manilius and his circles as shown by Manilius's understanding of the Aramaic pun of Pisces with Nineveh, and his knowledge of the Hebrew etymology of Babylon. In the absence of evidence from cuneiform tablets to the contrary (none of these associations are known to me in currently published Akkadian texts), it is probable that Manilius may have invented the Nineveh-Pisces association himself as a knowing pun. In any event, there was a tradition that the Arabs were astrologically associated with Taurus in Manilius's astrology at around the time that 4Q318 was copied, and that, furthermore, Manilius was acquainted with Hebrew and Aramaic word-plays.

Unlike Nineveh and Pisces, the origin of the link between Taurus and Arabia is not linguistic. Indeed, Ptolemy (fl. mid-second century C.E.) associates different native people and countries with Taurus and Venus.[155] It seems likely that the conceptual connection between the Arabs and Taurus in *4QBrontologion*, that is, of linking places on earth with zodiac signs, was connected to the late Babylonian tradition of zodiacal geography, and possibly plants and stones. It is likely that the tradition of astrological geography passed to the Greco-Roman world where it was developed in accordance with Mesopotamian and Greek mythologies. Where Manilius was concerned, there may have been an interested and receptive circle of learned astrologers with a relevant knowledge of Aramaic and Hebrew.

This section has identified a selection of different micro-zodiac texts with separate purposes in order to classify a seam of development in ancient

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154 Manilius, *Astronomica* 2.165 (Goold, LCL), Introduction, xxvi. J.H. Rogers, "Origins of the ancient constellations: I. The Mesopotamian traditions," *J. Br. Astron. Assoc.* 108.1 (1998): 27. In Babylonian iconography the sign is represented by two fishes with their tails tied together by a ribbon. According to Roman mythology, on the banks of the Euphrates [Mesopotamian origins] Venus and her son Cupid jumped into the river to escape the giant Typhon and changed themselves into two fishes, tied together by a rope. [Manilius does not mention Cupid, *Astronomica* 2.33, 4.579 (Goold, LCL), Introduction, xxvi.] See also Kerry McGruder's website, *Basic Celestial Phenomena*, retrieved 30 April 2014. http://kvmagruder.net/bcp/aster/constellations/Psc.htm#Description.

155 Ptolemy, *Tetrabiblos* II.3 (Robbins, LCL), 156–159. Ptolemy assigns Arabia Felix to Sagittarius, and Arabia to Aquarius. His Venus-ruled natives include India, Persia and Assyria; they are diviners, consecrate their genitals, heterosexual, despise homosexuality, wear effeminate clothes and have children by their mothers, 138–141.

scholarship toward the development of zodiac calendars and their purpose. It was found that interpretative astrological units accompany the Babylonian micro-zodiac models. The omen apodoses, cognate winds and empires are dependent upon a month or whole zodiac sign from which to create a prediction. Objects such as stones, plants, temples and cities are related to correlative divisions of the micro-zodiac. Forecasts of an individual's life and death also appeared to be related to the micro-zodiac. The dualistic framework of 4Q318 closely resembles a variant of the paradigm of an omen text whose apodosis is conditional on a micro-zodiac and accompanying months. The next section will review the scholarly discourse on how the ideal 360-day calendar may have functioned in Mesopotamia and the implications for *4QZodiac Calendar*.

1.4 The Babylonian Calendar, the 360-day Year and Intercalation

The purpose of this whole section is to help us understand how 4Q318 might work as an ideal calendar, to understand its possible astronomical and cultural origins, and to explore its possible relationship to the Hebrew calendar. It will thus be argued using an empirical methodology that *4QZodiac Calendar* did not die out at Qumran. The astronomical basis of 4Q318 that will be proposed will take into account the historical background of how months were measured in Mesopotamia. This is a complex area and we need to ascertain if 4Q318 followed one or more diachronic routes, or whether it is part of a genre, or a variant of a type of calendar.

It has been argued by Brown that the system of keeping the calendar in check was also associated with divination, and in the Neo-Assyrian period (1000–612 B.C.E.) it was part of the diviner's role to avert the prediction of an evil forecast, such as a bad omen for in a particular month, by calendrical manipulation.[156] Brown's hypothesis may intersect with the study of 4Q318 in that the Qumran calendar text is very clearly connected with thunder omen divination. The question of whether the user of 4Q318 would manipulate the zodiac calendar to obtain a more favourable prognostication is not answerable, although interesting.

The notion that *4QZodiac Calendar* comprises a simple list that has no calendrical relevance should be disregarded because the relationship between the moon's position in the zodiac and the months shows that there is a preconceived, luni-solar astronomical scheme. Before moving onto an overview

156 D. Brown, *Mesopotamian Planetary Astronomy-Astrology* (Groningen: Styx, 2000), 118–122, 152.

of scholarship on the Mesopotamian 360-day year, it is necessary to give a summary of the Babylonian calendar, with particular emphasis on how it was arithmetically regulated. The following constitutes the possible technical background to *4QZodiac Calendar*.

The lunar year of approximately 354 days is about 11 days behind the solar, or tropical, year of 365.24 days. In a luni-solar calendar, the festivals can be seasonally based. A certain number of days have to be added periodically to the lunar year, so that the (man-made) calendrical date is in the same season as the agricultural year since the seasons are solar, governed by the sun. This appended period of time is known as an intercalation; the lunar calendar is artificially corrected in order to keep up with the solar calendar by the addition of extra periods of time to compensate for the 11 or so days' shortfall each lunar year. A luni-solar calendar will affect the lunar date of the moon's position in the zodiac, so if no correction takes place, the date that the moon is in a sign each lunar year will simply regress by about 11 days.

According to most scholars, in the early fifth century B.C.E. the Babylonian system of calendation was standardised into a 19-year luni-solar cycle composed of 235 synodic lunar months, which equates to 19 solar or tropical years, as the basis for the civil calendar. After 235 synodic months, the sun and moon return to their initial sidereal positions at conjunction to within ¼°.[157] The months consist of 29 and 30 days intercalated seven times during the 19 solar years with an embolistic (or intercalary) 30-day month added in regular, fixed and repeated positions.[158]

The seven 30-day lunar months were intercalated at fixed intervals of three and two years, thereby creating seven 13-month lunar years of c. 384 days and twelve 12-month lunar years of c. 354 days in every 19-year cycle ($7 \times 13 = 91$; $12 \times 12 = 144$; $91 + 144 = 235$).[159]

157 Britton, "Calendars, Intercalations and Year-Lengths," 127, 130. The sidereal position here means the point, viewed from the earth, where the sun and moon have each returned to the same star relative to each other in the intervening 235-month period.

158 In Babylonia, this was a second Adar (XII_2) (also denoted as XII**) and a second Ululu, the sixth month (VI_2) (also denoted as VI**). According to Britton VI_2 was the first year of the cycle until it was discontinued in the fourth century B.C.E. during the reign of Artaxerxes I; it was resumed thereafter and continued in the Seleucid period, see Britton, "Treatments of Annual Phenomena," 33–36, fig. 4; idem, "Calendars, Intercalations and Year lengths," 122–24, fig. 7; Neugebauer, *Astronomical Cuneiform Texts* [*ACT*], 1.33; idem, *Exact Sciences*, 140; W.K. Pritchett and O. Neugebauer, *The Calendars of Athens* (Cambridge, MA: Harvard University Press, 1947), 3–14.

159 Britton, "Treatments of Annual Phenomena," 33; Britton, "Calendars, Intercalations and Year-Lengths," 121–124.

The twelfth month (spring: February/ March), Addaru, was intercalated six times, and the sixth month, Ululu (autumn: August/ September) was intercalated once in the 19-year cycle. Britton, whose arrangement tends to be followed by modern scholars, places the additional Ululu in the first year of the 19-year cycle, after 484 B.C.E.,[160] except during the reign of Aratxerxes I when it disappeared completely.[161] Neugebauer states that intercalations took place in years 1, 4, 7, 9, 12, 15 and 18 of the 19-year cycle and in the 18th year there was an additional Ululu.[162] Wacholder and Weisburg, following Parker and Dubberstein, place the intercalary Ululu in the 17th year of the 19-year cycle.[163]

In the Neo-Assyrian period the new month began when the lunar crescent was seen, thereby determining the length of the preceding month: whether it was 30 or 29 days in retrospect.[164] However, in the neo-Babylonian and Achaemenid periods the month-lengths were predicted in advance by various methods; this system was widely practised from 200 B.C.E., although there appears to have been no universal method of pre-calculation.[165]

There is a scholarly debate about whether the 19-year cycle was discovered independently by Meton in Athens on June 27, 432 B.C.E., at the summer solstice, the start of the Greek astronomical calendar, or if the Greeks learned the cycle from the Babylonians.[166] Britton's chronology places the standardisation of the cycle some 50 years before Meton.[167] In contrast, Neugebauer argues that

160 Britton, "Treatments of Annual Phenomena," 33; Britton, "Calendars, Intercalations and Year-Lengths," 122.

161 Britton, "Treatments of Annual Phenomena," 33, 36.

162 Neugebauer, *Astronomical Cuneiform Texts* or *ACT*?, 33; Neugebauer, *HAMA*, 356.

163 B.Z. Wacholder and D.B. Weisberg, "Visibility of the New Moon in Cuneiform and Rabbinic Sources," *HUCA* 24 (1971): 237; R.A. Parker and W.H. Dubberstein, *Babylonian Chronology 626 BC–AD 75* (Brown University Studies 19; Providence, RI: Brown University Press, 1956).

164 Britton, "Calendars, Intercalations and Year-Lengths," 115; J.M. Steele, "The Length of the Month in Mesopotamian Calendars," in *Calendars and Years* (2007), 133–140.

165 Steele, "The Length of the Month in Mesopotamian Calendars," 133, 140–144.

166 Evans, *History and Practice*, 185–186; Bowen and Goldstein, "Meton of Athens," 42, 42 n. 17; G.J. Toomer, "Ptolemy and his Predecessors," in *Astronomy before the Telescope*, 70–71; Walker and Britton, "Astronomy and Astrology in Mesopotamia," in *Astronomy before the Telescope*, 46; Stern, *Calendar and Community*, 31, n. 137; Rochberg, *Heavenly Writing*, 239–240; B.R. Goldstein, "A Note on the Metonic Cycle," *Isis* 57.1 (1966), 115–116 (115); Goldstein and Bowen, "A New View of Greek Astronomy," 337; Samuel, *Greek and Roman Chronology*, 21–22; A. Jones, "Evidence for Babylonian Arithmetical Schemes in Greek Astronomy," in *Die Rolle der Astronomie in den Kulturen Mesopotamiens* (ed. H.D. Galter; GMS 3; Graz: GrazKult, 1993), 80, n. 11.

167 Britton, "Calendars, Intercalations and Year-Lengths," 121–130 (Britton places the adoption of the 19-year cycle to 484 B.C.E.); idem, "Treatments of Annual Phenomena," 30–36.

the consistent use of the 19-year cycle in Babylonian calendrical texts did not occur until about 380 B.C.E., some 50 years after Meton.[168] Due to the wide disparity on the dating of the Mesopotamian version, Rochberg states that the 19-year cycle was introduced either shortly after 500 B.C.E., or near to 380 B.C.E.[169]

There are four basic types of years in the Babylonian 19-year cycle. (This categorisation subsumes the leap year with the intercalary Ulūlu and the year that follows it; they would give us six types of years.) These are:

(1) Seven regular years that follow an embolistic (intercalary) year; (2) five regular years that follow regular years; (3) two intercalary years which constitute the second year after the previous embolistic year when the moon can reach a very late position in the calendar; and (4) five intercalary years which constitute the third year after the previous embolistic year.

Due to the regular and fixed system of corrections to the lunar calendar the date when the moon is in any particular zodiac sign, the lunar-stellar, or lunar-zodiac position, should be possible to compute.

In ordinary years (1) and (2) the luni-solar date will be 10 or 11 days earlier than it was the year previously (the difference between the solar year of 365.24 days and the lunar year of 354 days, known as the 'epact,' is 11.24 days). Thus, the solar date in the following year (Y2) is c. 11 days' earlier in the solar year than the previous year's date (Y1). The luni-solar calendar arithmetic for when a lunar year is intercalated in the spring is thus:

Luni-solar Y2 = Y1–11 days

If the next year is an ordinary year, Y3, that date will fall another c. 11 days behind the tropical year:

Luni-solar Y3 = (Y1) – c. 11 days + (Y2) – c. 11 days = – c. 22 days behind Y1

Then, after the addition of an intercalary 30-day month the luni-solar date will be about 19 days ahead of the previous lunar year because the 30-day

168 Neugebauer, *Exact Sciences*, 140; Parker and Dubberstein, *Babylonian Chronology*, 2, 5; W.K. Pritchett and O. Neugebauer, *The Calendars of Athens*, Cambridge: Harvard University Press, 6; A Pannekoek, *A History of Astronomy* (George Allen and Unwin: London, 1961), 106–108, states that the Metonic cycle had still not been adopted in Athens by 340 B.C.E.

169 Rochberg, "Astronomy and Calendars in Ancient Mesopotamia," *CANE*, 3:1938.

addition to the year (Y4) has to compensate for the previous years' c.11-day slippage against the solar year, thus:

Luni-solar Y4 = Y3 + embolistic month (30 days) – c. 11 days = +19 days.[170]

So, for example, if the solar date in Y1 falls on 8 Tammuz, [the 8th day of the fourth luni-solar month, Tammuz], (Month IV 8), in Y2 it would be 27 Sivan (Month III 27), in Y3 it would be 16 Sivan (Month III 16) and in Y4 it would be 16 Tammuz (Month IV 16). If the astronomer knew the position of the year in 19-year cycle from the last intercalary Ulūlu, they then might be able to reckon the moon's position in the zodiac from the lunar zodiac calendar. However, keeping track of mentally adding and subtracting over 19 years requires some skill.

The Babylonian calendar was also interested in measuring the length of the tropical year from the time of the summer solstice to the next summer solstice. This astronomical refinement of the 19-year cycle appears in fragments of tablets from Uruk, dated to the fourth century B.C.E. Called the Uruk scheme by Neugebauer, his explanation was later modified by Slotsky, and Britton.[171] The first recorded summer solstice date of the 7th day of the fourth month (represented here as: Month IV 7 in 351 B.C.E.) would shift forwards or backwards *in reverse* to the above pattern in the 19-year cycle. The solstice date is 19 days ahead of the lunar year in the next regular year (Month III 18, 350 B.C.E.), and after an intercalation the date is 11 days behind the previous year's date (Month III 29, 349 B.C.E.).[172] The tablets contained an arithmetical scheme for about three centuries from which it was possible compute to the winter solstice and spring and autumn equinoxes, all based on calculation, not observation.[173]

Babylonian horoscopes were interested in the date of the nearest solstice or equinox to the birth-date.[174] This information would have enabled the

170 I thank Peter Nockolds for having shone a light on the different kinds of years and the arithmetic behind the shifting calendrical dates in a 19-year cycle.

171 Britton, "Treatments of Annual Phenomena," 22, 43–44 (fig. 7), 48, 51 n. 41, 78; A. Slotsky, "The Uruk Scheme Revisited," in *Die Rolle*, 359–366; O. Neugebauer, "A Table of Solstices from Uruk," *JCS* 1(1947): 143–148; O. Neugebauer, " Solstices and Equinoxes in Babylonian Astronomy during the Seleucid Period," *JCS* 2 (1948): 209–222.

172 See Britton, "Treatments of Annual Phenomena," 43–44 (Fig. 7, line 1–3), 48, 76–77 (Figure D: U 107+124 lines 1–3), 78.

173 Britton, "Treatments of Annual Phenomena," 43; Neugebauer, *HAMA*, 357–363.

174 F. Rochberg, "Babylonian Horoscopy: The Texts and their Relations," (1999), repr. in *In the Path of the Moon* (Leiden: Brill, 2010), 204; eadem, *Babylonian Horoscopes BH*? (Philadelphia: APS, 1998), 43–44.

astronomer-astrologer to identify whether an intercalation was due using an easier method than adding and substracting days and dates blindly through 19 years from the last previous intercalary Ulūlu, the marking point in the cycle. I suggest that the purpose of the Uruk scheme was, thus, probably for use as an astrological aid (in contrast to Britton, who wondered if the text was "an exercise in pointless precision?").[175] In a scheme whereby each day in the 360-day calendar represented a degree,[176] the moon's position in the zodiac would move forwards and backwards in the Babylonian calendar: forwards after an intercalation and then backwards after ordinary year. The implication is that a 'barefoot diviner,' that is, not a court astronomer-astrologer with access to astronomical archives and historical data,[177] could be aware of when years were intercalated by being familiar with the dates of the solstices and equinoxes, and thus be able to estimate the moon's sign from an ideal zodiac calendar.[178]

Having discussed the development of the zodiac towards the micro-zodiac with predictive interpretations, I shall now turn to the nature of the ideal 360-day year in Mesopotamia composed of 12 months of 30 days each. Since *4QZodiac Calendar* has 360 days, the issues that concern scholarship on the Mesopotamian 360-day year may also be relevant to 4Q318. One of the functions of the 360-day calendar in Mesopotamia was divinatory; however, unlike the standard Mesopotamian civil calendar, the method of how it worked is not clear. The ideal 360-day-year calendar consisting of twelve 30-day months, dates back to the administrative and civil calendar of the early third millennium (Ur III).[179] There is evidence that as an administrative calendar it was intercalated irregularly by having a 13-month year of 390 days; therefore, it was luni-solar. According to Brack-Bernsen, the 360-day calendar was intercalated every six years and it co-existed with the luni-solar calendar from c. 1800 B.C.E. to 300 B.C.E.[180] Hunger takes a similar view, contending that a

175 Britton, "Treatments of Annual Phenomena," 48.

176 Brack-Bernsen and Steele, "Babylonian Mathemagics," 95–121 (102, 110).

177 See F. Rochberg, "Scribes and Scholars: the *Ṭupšar Enūma Anu Enlil*," in *In the Path of the Moon*, 237–256. eadem, *Heavenly Writing*, 41, 45. H. Hunger, *Astrological Reports to Assyrian Kings* (SAA 8; Helsinki: Helsinki University Press, 1992). A.J. Sachs and H. Hunger, *Astronomical Diaries and Related Texts from Babylonia*,(completed and ed. H. Hunger; 5 vols.;Vienna: Verlag der Österreichischen Akademie der Wissenschaften, 1988–2001).

178 Further explored below in the subsection, "Cuneiform horoscopes and 4QZodiac Calendar."

179 R.K. Englund, "Administrative Timekeeping in Mesopotamia," *JESHO* 31 (1988), 121–185 (144, n. 17, 181).

180 L. Brack-Bernsen, "The 360-Day Year in Mesopotamia," in *Calendars and Years*, 89, 93–98. She argues that the 360-day-year Old Babylonian administrative calendar (c.2600 B.C.E.–c.300 B.C.E.) was intercalated with an additional 30-day month every six years.

360-day calendar would need to be intercalated every 5 or 6 years.[181] Britton had a different interpretation, arguing that the 360-day schematic year was "devoid of intercalations" by the end of the third millennium.[182]

The actual year-length in MUL.APIN is not stated. Assyriologists are divided as to whether the intercalation schemes in MUL.APIN Tablet II ii 11 and 17,[183] and Tablet II ii 12 and 16[184]—the rule whereby a correction of 10 days should be added to the year, and, equivalently, 30 days every three years—should be applied to the lunar year of 354 days, or to the ideal year of 360 days.[185] Brack-Bernsen suggests that the formula refers to the "real luni-solar year" [354 days];[186] Britton expands on this idea by suggesting that, therefore, a 364-day-year is implied, a calculation that was soon recognised as "inadequate to maintain a consistent calendar."[187]

Brown assumes that the method presumes a 360-day year,[188] a view shared by Koch.[189] The latter argued against the contention by Horowitz, and Albani that the formula in the MUL.APIN is based on a 354-day year, and that, therefore, adding 10 days would result in a year of 364 days, reflecting the year-length at Qumran [and *1 En.* 75:1–2, 82:4–6].[190]

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181 Oral communication with H. Hunger, February 2008.

182 J. Britton, "Calendars, Intercalation and Year-Lengths in Mesopotamian Astronomy," in *Calendars and Years*, 117–119; J. Britton, "Treatments of Annual Phenomena in Cuneiform Sources," 23; Brown, *Mesopotamian Planetary Astronomy-Astrology*, 247–248.

183 Hunger and Pingree, MUL.APIN, 94, 150–153.

184 Hunger and Pingree, MUL.APIN, 94–95.

185 This calendar is attested in the Old Babylonian text BM 17175+17284 and in the later tablets of the *EAE* Tablet 14 (seventh century B.C.E. Babylon to second century B.C.E. Uruk), see F.N.H. Al-Rawi and A.R. George, "Enūma Anu Enlil XIV and Other Early Astronomical Tablets," *AfO* 38/39 (1991–1992), 52–73; and the Astronomical Commentary in Hunger and Pingree, *MUL.APIN*, 139–140.

186 Brack-Bernsen, "The 360-Day Year in Mesopotamia," 97.

187 Britton, "Treatments of Annual Phenomena in Cuneiform Sources," 24–25; Britton, "Calendars. Intercalation and Year-Lengths," 126.

188 Brown, *Mesopotamian Planetary Astronomy-Astrology*, 119–120.

189 J. Koch, "AO 6478, MUL.APIN und das 364 Tage-Jahr," *NABU* 4.11 (1996): 97–99; J. Koch, "Kannte man in Mesopotamien das 364 Tage-Jahr wirklich seit dem 7 Jahrhundert v. Chr?," *NABU* 4.119 (1998): 109–115.

190 W. Horowitz, *Mesopotamian Cosmic Geography* (CM 8; Winona Lake, IN: Eisenbrauns, 1998), 184–185 n. 54; Horowitz, "The 360 and 364-Day Year in Ancient Mesopotamia," *JANES* 24 (1996), 40–41; Albani, *Astronomie und Schöpfungsglaube*, 197–200; Vanderkam, "Sources," 976–8 (2008); M. Albani, "Die lunaren Zyklen im 364-Tage-Festkalender von 4QMischmerot/4QS^{e}," *Mitteilungen und Beiträge* 4 (1992): 3–47; Hunger and Pingree, *Astral Sciences*, 84–86 (75–84 for intercalation schemes in the MUL.APIN); Brown, *Mesopotamian Planetary Astronomy-Astrology*, 59–60.

There is also a possibility that the ideal 360-day calendar in ancient Mesopotamia was apparently intercalated according to whether the moon and the Pleiades were in conjunction on the first of Nisan ("Pleiaden-Schaltregel"). This rule is attested in the MUL.APIN Tablet II Gap A 8–9[191] and possibly the earlier seventh century B.C.E., *The Babylonian Diviner's Manual*.[192] If the conjunction occurred on Nisan 3rd, according to the rule, the following year should be embolistic.[193] *The Babylonian Diviner's Manual*, which relates to an ideal calendar of 12 months and 360 days, gives rules for the adding of an extra month, to avoid a threatening omen (lines 57–71).[194] According to Clemency Williams, the diviner adjusted the 360-day schematic calendar to segue with the standard Mesopotamian calendar.[195] Another reason given for the Manual's instruction was, David Brown suggests, changing the date in order to avert a predicted evil omen, irrespective of whether intercalation was required for calendrical reasons to keep the moon on track with the solar years.[196]

Yet another well-known text implies that a possible 354- or 360-day calendar (it is not specifed) tampered with intercalation for apotropaic purposes: in the report sent by the royal astrologer, Balasî, to the Assyrian King, there is a request for an intercalation, in part, because not to do so would be unlucky.

> Let them intercalate a month; all the stars of the sky have fallen behind. Adar must not pass unfavourably; let them intercalate![197]

191 Hunger and Pingree, *MUL.APIN*, 89–90, 152–3.

192 A.L. Oppenheim, "A Babylonian Diviner's Manual," *JNES* 33 (1974), 197–220 (198 for sources), 205, 205 n. 37: Sm. 1088 + Sm. 1531 57–71; J. Schaumberger, "Die Plejaden-Schaltregel," in F.X. Kugler, *Sternkunde und Sterndienst in Babel* [*SSB*] (Supp. 3; Munich: Aschendorff, 1935), 340–344.

193 Brown, *Mesopotamian Planetary Astronomy and Astrology*, 118–122 n. 304; Horowitz, *Mesopotamian Cosmic Geography*, 151–152; Horowitz, "The 360 and 364 Day Year," 39; C. Williams, "Signs from the Sky, Signs from the Earth: The Diviner's Manual Revisited," in *Under One Sky*, 478–489; Bowen and Goldstein, "Meton of Athens," 41.

194 Oppenheim, "A Babylonian Diviner's Manual," 205.

195 Williams, "Signs from the Sky," 475.

196 Brown, *Mesopotamian Planetary Astronomy*, 120–122, 145–153, 195–197; N.M. Swerdlow, *The Babylonian Theory of the Planets* (Princeton, NJ: Princeton University Press, 1998) 8; L. Brack-Bernsen, "The 'days in excess' from MUL.APIN: On the 'first intercalation' and 'water clock' schemes from MUL.APIN," *Centaurus* 47 (2005): 15.

197 Hunger, *Astrological Reports* (no. 8098) 57, lines 8–10; Williams, "The Babylonian Diviner's Manual Revisited," 484.

Finally, an extispicy text showed that the ideal 360-day calendar was used as the basic time-unit to calculate how long the diviner's prediction from an animal's innards would remain in force.[198]

Britton suggests that the final form of the 19-year cycle in the standard 354/384-day Mesopotamian luni-solar calendar was not fixed until the second century B.C.E., or later. He further points out that there is no reference to a 365, or 365¼-day year in cuneiform sources.[199] It may be shown from the above survey that the ideal 360-day calendar was used for mantic purposes before the standardisation of the civil Mesopotamian calendar and the Babylonian 19-year cycle. Moreover, there is no consensus on how the ideal 360-day Babylonian calendar may have functioned, or how it developed, during its lifetime of some 3,000 years. In a similar vein, scholars do not know how the ideal schematic calendar in *4QZodiac Calendar* may have worked in practice.

1.4.1 *The 360-Day Year and the Micro-zodiac*

As discussed, the 360-day calendar in Mesopotamia co-existed with the standard Mesopotamian calendar and may have had more than one purpose over its extremely long existence. Several late Babylonian texts that post-date the final development of the zodiac utilised the 360-day calendrical model. Assyriologists have classified late Babylonian astronomical-astrological texts into two main groups, the 'Dodekatemoria'[200] and the '*Kalendertexte*' (Calendar texts).

There are a number of late Babylonian astrological and astronomical texts in both these groups in which the month-numbers are used to represent zodiac signs.[201] Roughton et al., suggest that the system of using month names to indicate zodiac signs "no doubt reflects the parallelism between the division of the ideal 360-day year into twelve 30-day months with the division of 360° into twelve 30° signs, which was the origin of the Babylonian zodiac."[202]

198 N.P. Heessel, "The Calculation of the Stipulated Term in Extispicy," in *Divination and Interpretation of Signs in the Ancient World* (ed. Amar Annus; OIS 6; Chicago: Chicago University Press, 2010), 163–175.

199 Britton, "Calendars, Intercalation and Year-Lengths," 130.

200 (Referred to earlier in this chapter in Sachs, "Babylonian Horoscopes," 72–73).

201 Hunger and Pingree, *Astral Sciences*, 17.

202 Roughton et al., "A Late Babylonian and Normal and *Ziqpu* Star Text," *AHES* 58 (2004): 537–572 (at 551–2); L. Brack-Bernsen and H. Hunger, "The Babylonian Zodiac: Speculations on its Invention and Significance," *Centaurus* (1999): 41, 280–292 (esp. 288); Brack-Bernsen, "The Path of the Moon," 16–31, (esp. 17, 24–26); Rochberg, *Heavenly Writing*, 129–130; Glessmer, "Calendars in the Qumran Scrolls," 259–260; Albani, "Horoscopes in

In some micro-zodiac texts, numbers can represent the corresponding month or signs of the zodiac (for example, 1 = Month I or Aries; 2 = Month II or Taurus, and so on); furthermore, months, both in name or month-number, can represent their corresponding zodiac signs.[203] The system of substitution of numerals for months and signs occurs in both groups of texts. In the '*Kalendertexte*' the month/signs move forwards to the next ordinal by 277° (or 83° backwards—as no years are given, the position in the zodiac is the same) in consecutive order in the columns.[204] In other words, in a 360° circular zodiac, if one moves forward by nine signs (they are all 30° each) + 7° (270 + 7 = 277°), or backwards by 3 signs + forwards by 7° (−90 + 7 = 83°), the position in the zodiac is the same (360° − 277° = +83°). In the 'Dodekatemoria' group, the ordinals are consecutively 13° ahead of the next.[205] There is no transparent explanation for this; one may suggest that by so-doing, the scribes created mathematical patterns, or puzzles, which may have been more interesting to work with, than straightforward linear data of the kind in 4Q318.

Brack-Bernsen and Steele published two new texts BM 96258 (1902–4–12, 370) and BM 96293 (1902–4–12, 405) that came from a purchased neo-Babylonian collection, mainly from Borsippa and Babylon. They are thought to have originated from about the fifth century B.C.E.; however, the dates are uncertain. As the arrangement of the numerical signs and months in these tablets is similar to those of the later '*Kalendertexte*,' that is, the zodiac positions in the columns progress by 277°, these two particular tablets would be significantly earlier than the other known '*Kalendertexte*,' some of which date to the second century and include texts in the *Gestirn Darstellungen* corpus, if they were of fifth century B.C.E. origin. Two other sets of known '*Kalendertexte*' can be dated with certainty to the late fourth century, and to the late third and early second centuries B.C.E. The implication being that the scheme could have developed soon after the first known use of the zodiac.[206]

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the Qumran Scrolls," in *The Dead Sea Scrolls after Fifty Years*, 2.300 n. 68; Greenfield and Sokoloff, DJD 36, 264.

203 Brack-Bernsen and Hunger, "The Babylonian Zodiac," 288; Brack-Bernsen, "The Path of the Moon," 16–31 (25); Reiner, *Astral Magic*, 114–116; L.E. Pearce, "Cuneiform Cryptography: Numerical Substitutions for Syllabic and Logographic Signs," (Ph.D. diss., Yale University, 1983).

204 Brack-Bernsen and Steele, "Babylonian Mathemagics," 98; Brack-Bernsen and Hunger, "The Babylonian Zodiac," 288; Steele, "Greek Influence?" 3; Hunger and Pingree, *Astral Sciences*, 29–30; van der Waerden in Weidner, *Gestirn-Darstellungen*, 50–52.

205 Neugebauer and Sachs, "Dodekatemoria," 52–53. Brack-Bernsen and Steele, "Babylonian Mathemagics," 118, nn. 33–34.

206 Brack-Bernsen and Steele, "Babylonian Mathemagics," 95–105.

The authors exchanged data between the '*Kalendertexte*' and 'Dodekatemoria' texts where the numbers represented the corresponding month-number or zodiac sign-number. They then produced what they called a 'Dodekatemoria scheme'[207] using the numbers to represent months composed of the micro-zodiac signs, all represented by their corresponding number. They contended that the resulting scheme "represents the mean motion of the moon [of 13° per day] during the ideal year of 360 days."[208] Brack-Bernsen has confirmed that this theoretical scheme is probably a calendar.[209] However, there is no independent evidence that this specific model was used in Babylonia; it may be purely an arithmetical construct.

If the ordinals in the authors' 'Dodekatemoria scheme' are exchanged back again for month names and zodiac signs the result is similar to *4QZodiac Calendar*, except that 4Q318 begins one sign ahead and the arrangement of the days differs slightly. The 'Dodekatemoria scheme' and 4Q318 have a distinctive but slightly different pattern of days assigned to zodiac signs. Both begin and end with the same sign. In the 'Dodekatemoria scheme,' the schematic arrangement of the number of days in which the moon stays in each zodiac sign in each 30-day month is 2–2–2–3–2–2–3–2–2–3–2–2–3 days. In 4Q318, the pattern is: 2–2–3–2–2–3–2–2–3–2–2–3–2 days, in both cases the purpose may be to apparently even out the problem of using fractions to denote that the moon stays in each of the 12 signs schematically for two and half days each month (30/12 = 2.5 days).

Each month in the 'Dodekatemoria scheme' begins and ends with the zodiac sign which is cognate with the lunar month itself, for example, Month 1 (March/ April) begins with Aries and ends with Aries, the sign in which the sun travels during that month and in which sun and the moon are ideally conjunct at the start of the lunar month. In *4QZodiac Calendar* each month begins and ends with the next cognate sign. Both schemes are synodic, encompassing 13 signs of the zodiac. Hence, the 'Dodekatemoria scheme' is closer to 4Q318 than the paradigm outlined in TCL 14.6 lines 6–20 and the *Gestirn Darstellungen* tablets discussed. The Dodekatemoria scheme's lunar zodiacal subdivisions are also in whole two- and three-day-long zodiac signs, as with *4QZodiac Calendar* not 2½ days or degrees per sign as with TCL 14.6.

An interesting difference between the 'Dodekatemoria scheme' and *4QZodiac Calendar* is that Brack-Bernsen and Steele's table, unlike 4Q318, lists the ideal degree at which the moon will enter the sign at sunset when the day begins. This increases by 13° each day, the ideal distance travelled by the moon

207 Brack-Bernsen and Steele, "Babylonian Mathemagics," 106–119 (119, Table 8).

208 Brack-Bernsen and Steele, "Babylonian Mathemagics," 118.

209 Oral communication with L. Brack-Bernsen, February 2010.

daily. In the table below, Table 1.4.1a, I have converted the month numerals in the 'Dodekatemoria scheme' back to zodiac signs, but otherwise reproduced the scheme as composed by the authors.[210] The degrees of a zodiac sign in the far right column have also been reproduced to show the moon's ideal position from sunset to sunset each day. In moving 13° each day, the moon should change sign every third day as each zodiac sign is 30°. The days of the month, days 1, 2, 3, 4, 5, 6, and so on, are presented as containing the moon's sign; by including the degrees it is clear that the moon may be in one sign for part of a day and in another sign for part of the same day. For instance, on the 9th of the month it is at 27° of the sign of the day of the month. It will move into the next sign six hours later (the moon travels ideally for two hours per degree; 27° is 3° which is six hours from entering the next sign, on the same date).

Table 1.4.1a begins at the conjunction (the moon changes signs every third or fourth day), Day 0 at 0°–13° Aries, from sunset to sunset.[211] The range for Month I, Day 1, is thus from 13° Aries (sunset, ideal first crescent) to 26° Aries (sunset next day), the moon stays within Aries during its daily orbit of 13°; Day 2: 26°Aries (sunset) to 9°Taurus (sunset next day), the moon changes signs during its daily orbit of 13°; Day 3: 9°–22° Taurus (staying in Taurus, sunset to sunset); Day 4: 22° Taurus–5° Gemini (moving into Gemini, sunset to sunset); ending the first month at Day 29, Nisan: 17°–30° Aries (ideal invisibility of the moon) and Day 30, Nisan: 30°Aries to 13° Taurus, the degree which is the beginning of Day 1, Month II. The last degree of a sign, 30° can be regarded as 0° of the next sign.[212] As another example of the moon changing signs within 13° of orbit: in Month II on Day 23 at sunset, to the next sunset, Day 24, the moon ideally travels from 29° Aquarius to 12° Pisces, the sign and degree that begins Day 24.

Schematic degrees have been added to *4QZodiac Calendar* in Table 1.4.1b, but in agreement with Wise's original hypothesis that the month began on the first crescent, I have commenced 4Q318 at 0° Taurus on Nisan Day 1. This would presuppose that the conjunction took place ideally at 17° Aries in keeping with the scheme of allowing 13° of mean lunar motion per day (0° Taurus minus 13° = 17° Aries, the previous sign).

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210 Brack-Bernsen and Steele, "Babylonian Mathemagics," 119, Table 8.

211 Following the mathematics of the '*Kalendertexte*,' Brack-Bernsen and Steele, "Babylonian Mathemagics," 107, 110. ("The last day of a month equals day zero of the next month, and degree 30 of a sign can be seen as degree 0 of the next sign," 107; "The '*Kalendertexte*' scheme for the whole ideal year gives a one-to-one correspondence between the 360 days of the ideal year and the 360 degrees (positions) of the zodiac," 110).

212 Brack-Bernsen and Steele, "Babylonian Mathemagics," 107–108.

In Hellenistic astrology, 19° Aries is the astrological exaltation (*hyposomata*) of the sun and 3° Taurus is the exaltation of the moon, data known from the later first century C.E. astrologer Dorotheus of Sidon.[213] Firmicus Maternus wrote that the system "in which planets are exalted in their 'houses' " may have originated in Babylonia, [214] a tradition that Rochberg suggests may have emanated from the Babylonian terminology *bīt niṣirti*, meaning "place of secrets." However, she comments:

> The original reasons for choosing the specific positions of the planets' *bīt niṣirti*, or *hyposomata*, remains obscure, but the *hyposomata* of the sun in Aries and the moon in Taurus, suggest some underlying calendaric rationale, since these "planets" occupy these signs at the beginning of the year.[215]

This remark inadvertently describes the ideal astronomical structure of 4Q318. Both schemes represented in Tables 1.4.1a and 1.4.1b depict a synodic month, beginning at the conjunction and moving to first crescent (on Day 0 in Month 1 only), ending at the conjunction and the moon's return to the first crescent phase (Day 30 which is equivalent to Day 0). As stated above, the sun will have apparently moved on 30° during the month with an ideal mean motion of 1° per day, [216] the moon will have travelled a full circuit of the zodiac of 360°, plus the 30° of the sun's journey during the month (in fact, the earth's orbit around the sun), to return to the same phase. So, as discussed, each month the moon travels 390° travelling again through the first sign that it started out from at the beginning of the month.[217] Both tables will be discussed individually and used to examine the Babylonian horoscopes in the next sub-section.

By beginning Month I, Day 1 at 13° Aries in the 'Dodekatemoria scheme,' the ideal conjunction between the sun and moon must occur in the zodiac when the moon is at 0° Aries on Day 0. A distance of 12°–13° separation from

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213 D. Pingree, ed., *Dorotheus Sidonius: Carmen Astrologicum* (Leipzig: Teubner, 1976), Appendix II, 323–324, cited in Julius Firmicus Maternus, *Mathesis* (ed. K.B. Riske; trans. J.H. Holden; Tempe, AZ: American Federation of Astrologers, 2011), 40, n. 3.

214 F. Rochberg, "Elements of the Babylonian Contribution to Hellenistic Astrology," repr. in *In the Path of the Moon*, 155.

215 Rochberg, "Elements of the Babylonian Contribution," 155, 147, 153–154. See also *eadem, Babylonian Horoscopes* (TAPS 88; Philadephia: APS, 1998), 46–49 [afterwards abbrev. as *BH*].

216 Neugebauer, *Exact Sciences*, 106.

217 Neugebauer, *Exact Sciences*, 106–107.

TABLE 1.4.1a *The 'Dodekatemoria scheme' with numbers converted to corresponding month names and zodiac signs*

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Sunset to sunset
0	0°-13°♈												
1	♈	♉	♊	♋	♌	♍	♎	♏	♐	♑	♒	♓	13°–26°
2	♈	♉	♊	♋	♌	♍	♎	♏	♐	♑	♒	♓	26°–9°
3	♉	♊	♋	♌	♍	♎	♏	♐	♑	♒	♓	♈	9°–22°
4	♉	♊	♋	♌	♍	♎	♏	♐	♑	♒	♓	♈	22°–5°
5	♊	♋	♌	♍	♎	♏	♐	♑	♒	♓	♈	♉	5°–18°
6	♊	♋	♌	♍	♎	♏	♐	♑	♒	♓	♈	♉	18°–1°
7	♋	♌	♍	♎	♏	♐	♑	♒	♓	♈	♉	♊	1°–14°
8	♋	♌	♍	♎	♏	♐	♑	♒	♓	♈	♉	♊	14°–27°
9	♋	♌	♍	♎	♏	♐	♑	♒	♓	♈	♉	♊	27°–10°
10	♌	♍	♎	♏	♐	♑	♒	♓	♈	♉	♊	♋	10°–23°
11	♌	♍	♎	♏	♐	♑	♒	♓	♈	♉	♊	♋	23°–6°
12	♍	♎	♏	♐	♑	♒	♓	♈	♉	♊	♋	♌	6°–19°
13	♍	♎	♏	♐	♑	♒	♓	♈	♉	♊	♋	♌	19°–2°
14	♎	♏	♐	♑	♒	♓	♈	♉	♊	♋	♌	♍	2°–15°
15	♎	♏	♐	♑	♒	♓	♈	♉	♊	♋	♌	♍	15°–28°
16	♎	♏	♐	♑	♒	♓	♈	♉	♊	♋	♌	♍	28°–11°
17	♏	♐	♑	♒	♓	♈	♉	♊	♋	♌	♍	♎	11°–24°
18	♏	♐	♑	♒	♓	♈	♉	♊	♋	♌	♍	♎	24°–7°
19	♐	♑	♒	♓	♈	♉	♊	♋	♌	♍	♎	♏	7°–20°
20	♐	♑	♒	♓	♈	♉	♊	♋	♌	♍	♎	♏	20°–3°
21	♑	♒	♓	♈	♉	♊	♋	♌	♍	♎	♏	♐	3°–16°
22	♑	♒	♓	♈	♉	♊	♋	♌	♍	♎	♏	♐	16°–29°
23	♑	♒	♓	♈	♉	♊	♋	♌	♍	♎	♏	♐	29°–12°
24	♒	♓	♈	♉	♊	♋	♌	♍	♎	♏	♐	♑	12°–25°
25	♒	♓	♈	♉	♊	♋	♌	♍	♎	♏	♐	♑	25°–8°
26	♓	♈	♉	♊	♋	♌	♍	♎	♏	♐	♑	♒	8°–21°
27	♓	♈	♉	♊	♋	♌	♍	♎	♏	♐	♑	♒	21°–4°
28	♈	♉	♊	♋	♌	♍	♎	♏	♐	♑	♒	♓	4°–17°
29	♈	♉	♊	♋	♌	♍	♎	♏	♐	♑	♒	♓	17°–30°
30	♈	♉	♊	♋	♌	♍	♎	♏	♐	♑	♒	♓	30°–13°

Key: Aries ♈; Taurus ♉; Gemini ♊; Cancer ♋; Leo ♌; Virgo ♍; Libra ♎; Scorpio ♏; Sagittarius ♐; Capricorn ♑; Aquarius ♒; Pisces ♓. The moon changes sign every 2½ days, travelling 13° daily

TABLE 1.4.1b 4QZodiac Calendar *with schematic degrees*

	Nisan	Iyyar	Sivan	Tammuz	Av	Elul	Tishri	Heshvan	Kislev	Tevet	Shevat	Adar	Sunset to sunset
	17° ♈												
1	♉	♊	♋	♌		♍	♎	♏	♐	♑	♒	♓	0°–13°
2	♉	♊	♋	♌		♍	♎	♏	♐	♑	♒	♓	13°–26°
3	♊	♋	♌	♍		♎	♏	♐	♑	♒	♓	♈	26°–9°
4	♊	♋	♌	♍		♎	♏	♐	♑	♒	♓	♈	9°–22°
5	♋	♌	♍	♎		♏	♐	♑	♒	♓	♈	♉	22°–5°
6	♋	♌	♍	♎		♏	♐	♑	♒	♓	♈	♉	5°–18°
7	♋	♌	♍	♎		♏	♐	♑	♒	♓	♈	♉	18°–1°
8	♌	♍	♎	♏		♐	♑	♒	♓	♈	♉	♋	1°–14°
9	♌	♍	♎	♏		♐	♑	♒	♓	♈	♉	♋	14°–27°
10	♍	♎	♏	♐		♑	♒	♓	♈	♉	♋	♌	27°–10°
11	♍	♎	♏	♐		♑	♒	♓	♈	♉	♋	♌	10°–23°
12	♎	♏	♐	♑		♒	♓	♈	♉	♋	♌	♍	23°–6°
13	♎	♏	♐	♑		♒	♓	♈	♉	♋	♌	♍	6°–19°
14	♎	♏	♐	♑		♒	♓	♈	♉	♋	♌	♍	19°–2°
15	♏	♐	♑	♒		♓	♈	♉	♋	♌	♍	♎	2°–15°
16	♏	♐	♑	♒		♓	♈	♉	♋	♌	♍	♎	15°–28°
17	♐	♑	♒	♓		♈	♉	♋	♌	♍	♎	♏	28°–11°
18	♐	♑	♒	♓		♈	♉	♋	♌	♍	♎	♏	11°–24°
19	♑	♒	♓	♈		♉	♊	♋	♌	♍	♎	♏	24°–7°
20	♑	♒	♓	♈		♉	♊	♋	♌	♍	♎	♏	7°–0°
21	♑	♒	♓	♈		♉	♊	♋	♌	♍	♎	♏	20°–3°
22	♒	♓	♈	♉		♊	♋	♌	♍	♎	♏	♐	3°–16°
23	♒	♓	♈	♉		♊	♋	♌	♍	♎	♏	♐	16°–29°
24	♓	♈	♉	♊		♋	♌	♍	♎	♏	♐	♒	29°–12°
25	♓	♈	♉	♊		♋	♌	♍	♎	♏	♐	♒	12°–25°
26	♈	♉	♊	♋		♌	♍	♎	♏	♐	♒	♓	25°–8°
27	♈	♉	♊	♋		♌	♍	♎	♏	♐	♒	♓	8°–21°
28	♈	♉	♊	♋		♌	♍	♎	♏	♐	♒	♓	21°–4°
29	♉	♊	♋	♌		♍	♎	♏	♐	♒	♓	♈	4°–17°
30	♉	♊	♋	♌		♍	♎	♏	♐	♒	♓	♈	17°–30°

Key: Aries ♈; Taurus ♉; Gemini ♊; Cancer ♋; Leo ♌; Virgo ♍; Libra ♎; Scorpio ♏; Sagittarius ♐; Capricorn ♑; Aquarius ♒; Pisces ♓. The moon changes sign every 2½ days, travelling 13° daily

the sun is the ideal elongation when the first crescent could be observed in perfect weather conditions.[218] Arithmetically, this situation fits with the moon's orbit in a synodic month, as discussed above (390° ÷ 30 days = 13° per day) and according to the basic scheme identified by Brack-Bernsen and Steele whereby there is a "one-to-one correspondence between the 360 days of the ideal year and the 360 (positions) of the zodiac)."[219]

In Table 1.4.1b, I have superimposed hypothetical degrees onto *4QZodiac Calendar* using the same system as the 'Dodekatemoria scheme,' except it is here suggested that the conjunction at the beginning of the calendar year occurred at 17° Aries and the first day commenced when the moon had reached 0° Taurus (= 30° Aries), the ideal first crescent at 13° elongation from the sun. The Day 1 of each month begins when the moon is at 0° of the sign; conjunction takes place on Day 30 of the previous month.[220]

I would suggest that in 4Q318, the reason that the moon is one sign ahead of Aries in the 'Dodekatemoria scheme' (in Taurus) might be because the compositions have mathematically arranged the moon's ideal position in different years. The month of Adar, Month XII, in *4QZodiac Calendar* corresponds closely to Month I in the new 'Dodekatemoria scheme' (both months begin with the moon in Aries). Hence, 4Q318 is one column, or the equivalent to one sign ahead of the 'Dodekatemoria scheme.' It is possible that the apparent variation in the Qumran text may be indicative of intercalary years or the years immediately after an intercalation. This hypothesis will be tested in Section 1.4.3.

In summary, I have advanced the scheme of a hypothetical, ideal, schematic 360-day Mesopotamian calendar, reconstructed by Brack-Bernsen and Steele, to demonstrate its affinity with *4QZodiac Calendar*. There are significant differences between these ideal zodiac calendar models, but there are also important similarities. The variations between the Babylonian 'Dodekatemoria scheme' and *4QZodiac Calendar* may suggest that the transmission of astronomical-astrological knowledge possibly from the early 400s B.C.E. onwards between

218 Stern, *Calendar and Community*, 100–103, 110–111; Neugebauer, *Exact Sciences*, 106–107; L.J. Fatoohi and F.R. Stephenson, "Angular Measurements in Babylonian Astronomy," *AfO* 44/45 (1997–8): 210–214. See also B.E. Schaefer, "Lunar Crescent Visibility," *Q.J.R. Astron. Soc.* 27 (1996): 759–768 for summary and bibliography of actual crescent spotting data: a 15 hours-old moon being the youngest seen with the naked eye (esp. 759, 768).

219 Brack-Bernsen and Steele, "Babylonian Mathemagics," 110.

220 In my Ph.D dissertation (H.R. Jacobus, Manchester University, 2011) I had placed the degrees in Table 1.4.1b to begin at 13° Taurus. The data and discussion in the next section has been changed accordingly. Sub-sections 1.4.2 and 1.4.3 are additions.

Mesopotamia and Judea involved a development in the ideal 360-day calendar, or that the scheme may have accommodated differences.

This hypothesis places *4QZodiac Calendar* in its astronomical context within the history of ideal 360-day Mesopotamian calendars, and pinpoints its origins on the model of the 'Dodekatemoria scheme.' There is more textual support for this premise than for the supposition that *4QZodiac Calendar* is associated with a *thema mundi*, or that it is directly derived from MUL.APIN. I have also explored the scholarship on the micro-zodiac and argued that *4QZodiac Calendar* may be descended from specific Mesopotamian developments in these ideal 360-day calendar schemes, which incorporate innovative or revised models. In the next sub-section, I shall examine the 'Dodekatemoria scheme' and *4QZodiac Calendar* against real data from antiquity, the Babylonian horoscopes, to see if the ideal tables reflected in the hypothetical late Babylonian and Qumran schemes could have been used in a practical context.

1.4.2 *Cuneiform Horoscopes and* 4QZodiac Calendar

The Babylonian zodiac, consisting of twelve signs each made up of 30° appeared "around the middle of the second half of the middle of the fifth century B.C.E.,"[221] and its invention enabled astronomers to give the longitude of the moon and the sun and the planets in measurements of zodiac degrees, rather than according to particular areas, such as named stars in zodiacal constellations.[222] According to van der Waerden, the division of each zodiac sign into 30 degrees was developed in order to correspond with a crude solar month, that is the time that it takes for the sun to transit each sign: "the twelvefold division of the sun's path" was "fundamental not only in astronomy, but also in astrology: the practice of horoscope astrology is based on it."[223] Horoscopic astrology, also known as genethlialogy, is the art of casting birth charts from which an astrologer foretells a person's fate based on the position of the sun, moon and five planets at the time of birth; the practice is attested in Mesopotamia in the late fifth century B.C.E.[224] The subject, usually an unnamed person, is signified by the phase, "a child is born."[225]

221 Britton, "Treatments of Annual Phenomena," 36.

222 Rochberg, *Heavenly Writing*, 126–33.

223 B.L. van der Waerden, *Science Awakening II* (Leiden: Noordhoff, 1974), 287.

224 Sachs, "Babylonian Horoscopes," 52–57; Rochberg, *BH*, 51–55; F. Rochberg-Halton, "Babylonian Horoscopes and their Sources," *Or* NS 58 (1989): 111–114; *eadem*, "New Evidence for the History of Astrology," 18.

225 Rochberg, *Heavenly Writing*, 103; *eadem, BH*, 4–6, horoscope text editions: 51–147.

The textual content is formulaically structured according to a cosmological model beginning with the year (most are dated in the Seleucid era), and the day of the month, whether the month is full or hollow (30 or 29 days, respectively) with the Babylonian month names.[226] The zodiacal positions of the moon, sun, Jupiter, Venus, Saturn, Mars and Mercury are listed in that order.[227] The time of birth is measured by the seasonal hour, the watch, or its proximity to sunrise. The date of the nearest lunar or solar eclipse to the birth date is included in the data, the nearest solstice date, thereby placing it in the Uruk scheme and its position in the 19-year cycle.[228] This information would have told the astrologer whether the year of the birth date was intercalary. A large proportion of texts concerned with horoscopy also existed in Hellenistic Uruk from 250 B.C.E. and thereafter in Babylon from the second century B.C.E.[229]

I will compare the position of the moon in the zodiac on given dates in a sample of Babylonian horoscopes collected by Rochberg[230] against corresponding data in the 'Dodekatemoria scheme' and *4QZodiac Calendar*. The aim of the quantitative comparisons is to consider whether a micro-zodiac system of a similar model to that of the 'Dodekatemoria scheme' and *4QZodiac Calendar* could have functioned as ideal lunar ephemerides in some cases (though there is no evidence that they were used in practice). It is generally assumed that none of the cuneiform horoscopes were reckoned by observation but computed with the use of almanacs and other sources, such as astronomical Diaries.[231] As shown by Rochberg, sometimes where the zodiacal degrees do exist there are discrepancies between the ancient data and modern computation of the planetary, solar and lunar position in their zodiac signs.[232] She further comments:

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226 Rochberg, *BH*, 35; *eadem, Heavenly Writing*, 103.

227 Rochberg, *BH*, 7, 9, 39, 45.

228 For example, Rochberg, *BH*, 78: Text 8 (BM36943), rev. 1–2, the winter solstice date is given as the 8th of the 10th month, Tebētu, 251 B.C.E., a position that corresponded with the 5th year of the 19-year cycle in the Uruk scheme.

229 O. Neugebauer, *Astronomical Cuneiform Texts* [*ACT*], 1:11, 41–2; F. Rochberg, "The Cultural Locus of Astronomy in Late Babylonia," in *Die Rolle der Astronomie in den Kulturen Mesopotamiens* (ed. H. Galter; GMS 3. Graz: GrazKult, 1993), 31–45.

230 Rochberg, *BH* various pages to be cited; Rochberg, *Heavenly Writing*, 103–107.

231 Stol, *Birth in Babylonia*, 96; Hunger and Pingree, *Astral Sciences*, 27; Rochberg, *Heavenly Writing*, 145–163 (esp. 156–157); P.-A. Beaulieu and F. Rochberg, "The Horoscope of Anubēl-sunu," *JCS* 48 (1996): 90; F. Rochberg-Halton, "Babylonian Seasonal Hours," *Centaurus* 32.2 (1989): 156–160.

232 F. Rochberg, "Babylonian Horoscopy: The Texts and Their Relations," in *Ancient Astronomy and Celestial Divination*, 39–59, see Table 1, p. 46; also Rochberg-Halton, "Babylonian Horoscopes and their Sources," 102–123.

> ...we still cannot confidently identify the ancient methods used to obtain their results.[233]

The following analysis will suggest that one of the horoscopic methods may have been to include the use of schematic lunar zodiac calendars to ascertain and compute the position of the moon in a horoscope. Of the fewer than 30 Babylonian horoscopes from the late fifth (c.400 B.C.E.) to the first century B.C.E. (50 B.C.E.) collected by Rochberg, about 24 give the zodiac signs of the moon at the time of birth.[234] Her numbering of texts reflects the chronological ages of the tablets (later horoscopes have higher numbers); the earlier texts describe data in terms of Normal Stars[235] and zodiacal constellations.

Late third century B.C.E. texts include the moon's zodiac sign for the time that the child of the horoscope was born in addition to the zodiacal constellations. Texts after the mid-second century B.C.E. use the zodiac signs as the norm; the earliest attested, dating to the mid third century B.C.E. from Uruk.[236] Six horoscopes contain the degree of the moon within the zodiac sign, five of which are in error, varying from two hours to more than a day when checked with modern computation by Rochberg, and my own programme.[237] I have here analysed a selection of the Babylonian horoscopes dating from 263 B.C.E. to 69 B.C.E. This sample contains the texts that state the degree of the moon in its zodiac sign, and most of those that attest the lunar zodiac sign only, without the degree.[238]

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233 Rochberg, *BH*, 21.

234 F. Rochberg, "Lunar Data in Babylonian Horoscopes," *Centaurus* 45 (2003): 32–45, 32, 44 n. 2 lists: *BH*: 9, 10, 12, 16a, 16b [*BH* states "16"], 19, 20, 21, 22a, 22b, 23, 24, 25, 26, 27 (repr. *In the Path of the Moon*, 259); in addition horoscopes giving the zodiac sign of the moon at the time of the birth of the child include include Texts 8, 13, 14, 15, 17 and 18.

235 Some 32 reference stars dotted around the ecliptic noted in terms of the positions of the moon and planets, Rochberg, *Heavenly Writing*, 125; J. Epping, *Astronomisches aus Babylon: Stimmen aus Maria Laach* (Ergänzungsheft 44; Freiburg im Breisgau: Herder'sche Verlagshandlung, 1889), 115; Sachs and Hunger, *Diaries*, 17–19; Hunger and Pingree, *Astral Sciences*, 148–151 (list 148–9); G. Grasshoff, "Normal Star Observations in Late Babylonian Astronomical Diaries," in *Ancient Astronomy and Celestial Divination*, 123, Table 6; Neugebauer, *HAMA*, 545.

236 Rochberg, "Lunar Data in Babylonian Horoscopes," 34.

237 Rochberg, *BH*: Texts 5, 9, 16a, 23, 26, 27; Rochberg-Halton, "Babylonian Seasonal Hours," 157–158; "Babylonian Horoscopy," Table 2, p. 47 in *Ancient Astronomy and Celestial Divination*. I used the computer program Astrocalc (CD) [afterwards abbreviated as AC]. The results were the same.

238 Rochberg, *BH*: Texts 8, 10, 12, 13, 14, 15, 16b, 17, 18, 19, 20, 21, 26.

As stated, the standard Babylonian calendar is intercalated seven times in a 19-year cycle: with an Ulūlu II (Month VI_2) in the first year of the cycle. In addition, the following six intercalary years have an Adarru II (Month XII_2): years 3, 6, 9, 11, 14, 17 of the 19-year cycle.[239] It is possible to confirm which years are intercalary in the Babylonian calendar from the Parker-Dubberstein (PD) tables, Britton's tables, and the online Seleucid-Julian date tables compiled by Chris Bennett.[240] I have included this information, below.

Rochberg computed the degree of the zodiac sign of the moon for all of the texts based on the date (day, month and year), the positions of the sun, the moon and other planets for the segment of day (the hour) or night (the watch) that the child was born, as stated in each horoscope.[241] In Table 1.4.2a, below, the degree of the moon in the zodiac for the day and month (without the year) in the Babylonian horoscopes has been compared with the lunar zodiacal position for the same day and month, without the year, in the 'Dodekatemoria scheme' (DS) and 4Q318 (derived from Tables 1.4.1a and 1.4.1b).

Data for horoscopes where the moon's zodiac degree was not reckoned in the ancient text have been indicated with a {C} to show Rochberg's computation has been used and confirmed. Where the degree was given in the ancient text (indicated by direct quote marks), modern computation for the data has been given, too.[242] The texts in Table 1.4.2a are listed according to the *BH* text

239 Britton, "Treatments," 35 (fig. 4); idem, "Calendars, Intercalations and Year-Lengths," 23, (fig. 7). Cf. Neugebauer, *ACT*, 33.

240 Parker and Dubberstein, *Babylonian Chronology*; Chris Bennett, "Babylonian and Seleucid Dates," online: http://www.tyndalehouse.com/Egypt/ptolemies/chron/babylonian/chron_bab_anl.htm . (Includes corrections to Parker and Dubberstein's tables).

241 Rochberg-Halton, "Babylonian Seasonal Hours," 163–164. To ascertain and test the given dates in the texts, *BH* used the "Babylonian" zodiac system, that is, the sidereal longitudes, set for the time-zone and co-ordinates of Babylon (three hours ahead of Greenwich Mean Time [GMT], also known as Universal Time [U.T.]), and factored a correction value for precession. I double-checked the *BH* calculations using the computer program AC, which agreed with Rochberg to about a degree. The Julian date follows the midnight epoch (midnight to midnight); the Babylonian date, from sunset to sunset. The hour, or part of night and day in the Babylonian day determines the converted Julian date: the first part of the night in the Babylonian day will be the previous day in the Julian calendar. See Rochberg, *BH*, 19–21. The converted Julian calendar dates run from Jan 1 to Jan 1; the Seleucid Era dates run from Tishri to Tishri, and the Babylonian calendar dates from Nisan to Nisan.

242 Note. The data for Texts 16a (rev.) and 16b (obv.) in *BH* 100–104 is correct however the tablet numbers have been reversed in Rochberg, "Babylonian Horoscopy," Table 1 and Table 2, *In the Path of the Moon*, 197–198.

TABLE 1.4.2a *"Raw" lunar data in the* Babylonian Horoscopes *ordered according to tablet number (age: lowest numeral = oldest) compared to the lunar data in the 'Dodekatemoria scheme' (col. 4)and 4Q318 (col. 4). based on the day and month of the horoscope birth date*

1 *BH*	Col 2 Text birth date	Col 3 Moon's degree for birth	Col 4 Dodekatemoria scheme	Col 5 4Q318
5	23?/XII* April 24, 263 BCE	"10° Aquarius" {11°}	29° Sag–12° Cap	16°–29° Cap
8	8/IX Nov. 28/ 29, 251 BCE	27° Pisces {C}	14°–27° Pisces	1°–14° Aries
9	2/X Dec. 29, 249BCE	"12° Aquarius" {15°}	26° Cap–9° Aq	13°–26° Aq
10	4/III June 2/3, 235 BCE	6° Leo {C}	22° Can–5° Leo	9°–22° Virgo
12	28/III July 2, 230 BCE	2° Cancer {C}	4°–17° Gemini	21° Gem–4° Can
13	4/V July 29, 224 BCE	0° Libra {C}	22° Virgo–5° Libra	9°–22° Libra
14	12/VII Oct. 21, 220 BCE	8° Aries {C}	6°–19° Pisces	23° Pi–6° Aries
15	9/XI Feb. 4, 202 BCE	27° Taurus {C}	27° Tau–10° Gem	14°–27° Gemini
16a	3/III June 5, 200 BCE	"15° Cancer" {29°}	9°–22° Cancer	26° Can–9° Leo
16b	14/VII Oct. 31, 199 BCE	18° Taurus {C}	2°–15° Aries	19° Aries–2° Tau
17	(19?)/VII Oct. 20? 176 BCE*	14° Gemini {C}	7°–20° Gemini	24° Gem–7° Can
18	6/XII March 1, 142 BCE	3° Gemini {C}	18° Tau–1° Gemini	5°–18° Gemini
19	13/VI Sept. 7, 140 BCE	3° Pisces {C}	19° Aq–2° Pisces	6°–19° Pisces
20	24/V Aug. 16, 126 BCE	25° Gemini {C}	12°–25° Gemini	29° Ge–12° Can
21	22/VI Oct. 1, 125 BCE	"Beginning of Leo" {0°}	16°–29° Gemini	3°–16° Cancer
22a	2/IV July 5, 117 BCE	5° Virgo {C}	26° Gem–9° Cancer	13°–26° Leo
23	9/X Jan. 5, 88 BCE	"5° Taurus" {3°}	27° Ar–10° Taurus	9°–27° Taurus
26	25/26/V Sept. 4, 76 BCE	17° Leo {C}	25° Gem–21° Cancer	12° Can–8° Leo
27	20/I April 16, 69 BCE	"18° Cap" {28°}	20° Sag–3° Cap	20° Cap–3° Aq

Columns 4 and 5 show the moon's position for the *DS* and 4Q318 for the day of the month in *BH* texts (cols. 1–2) in comparison with the horoscope text data (col. 3)
*The full date of the text is missing.

numeral,[243] thus according to the age of the tablets. The data in Table 1.4.2a are, therefore, raw and unsorted and simply show the position of the 13° degree range of the moon's position on the dates in the "DS" and 4Q318 that correspond with the dates in the cuneiform texts for the dates of birth. **Col. 1.** lists the *BH* Text number; **col. 2.** lists the position of the moon in the zodiac in the horoscope birth-date, with the degree in the text (if given) and the computed degree; **col. 3.** lists the moon's position on that date in the DS according to Table 1.4.1a; **col 4.** lists the moon position on that date in the *4QZodiac Calendar*, according to Table 1.4.1b.

The above comparsions show that some lunar data in texts fall within range of the "DS" and others correspond with 4Q318 for the given days of the month in the horoscopes.[244] In yet other tablets, the lunar data border both schemes by up to five degrees, the equivalent of a several hours, or is out of range by more than five degrees.[245] In order to test my hypothesis that 4Q318 is an ideal calendar that may be of use for determining the position of the moon in the zodiac in some years in the 19-year cycle, particularly following embolistic years, the data are now organised in order according to the time interval between the horoscope birth date and last previous date of intercalation: the Nearest Previous Intercalation Date (NPID).

The time difference from the NPID, from about a month to nearly three years from the given date of birth (BH Birth Date, BHBD) have been reckoned using the online Babylonian and Seleucid tables.[246] There is likely to be a few days' error in the time difference the because the month lengths of 29 and 30 days are in irregular sequences (for working purposes I have assumed all months have 30 days and prefixed the data below with "c." to denote an approximation).

It is possible that when the moon was not visible the Babylonian astronomer-astrologer would, theoretically, be able to ascertain the moon's position from the date of the previous solstice or equinox. Rochberg found that the horoscope birth dates were never more than two months on either side of a solstice or an equinox, the date of which would be calculated in the Uruk scheme. The mantic significance of the solstice and equinox date is not known;[247] they served to place the year of the horoscope within the 19-year cycle. The pur-

243 Rochberg, *BH*, Text editions, pp. 51–147, various.

244 *BH* text dates where the moon's zodiac position falls within range of the DS dates and lunar position are: nos. 8, 13, 15, 17, 23; text dates and lunar positions that fall within range of 4Q318 are: 9, 12, 16a, 27 (agreeing with text error).

245 *BH* text dates and lunar positions on the cusp with both the DS and 4Q318 are: 10, 14, 18, 19, 20. Out of range to both by more than 5 degrees: 5, 16b, 21, 22a, 26.

246 Chris Bennett, "Babylonian and Seleucid Dates" online tables: http://www.tyndalehouse.com/egypt/ptolemies/chron/babylonian/chron_bab_cal.htm.

247 Rochberg, *BH*, 43–44, Table 3.2.

pose of including the date of the solstice or equinox closest to the birth-date could be to enable the astrologer to know if the year was embolistic or not, and which of the four kinds of years it was (see the beginning of this Section 1.4). Therefore, they would have been able to calculate the moon's degree of the zodiac with the aid of a calendar designed to give the moon's ideal position on a given date. This hypothesis is now tested using the sample of Babylonian horoscopes.

Staying with unsorted data, Table 1.4.2b lists the date of birth in the horoscope texts, BHBD (**cols. 1, 2**), as above with NPID (**col. 3**), the Difference in time between the BHBD and the NPID (**col. 4**), the Computed Time of the Birth using a sunset to sunset day count (**col. 5**),[248] and the page ref. in *BH* summarising each horoscope's data (**col. 6**).

TABLE 1.4.2b *Nearest Previous Intercalation Dates (NPID) and the difference in time with the* BH *birth date (BHBD)*

Col 1 BH text no.	**Col 2** BHBD	**Col 3** NPID	**Col 4** Difference	**Col 5** Computed Time of Birth	**Col 6** BH. Ref.
5	23?/XII* April 24, 263 BCE	March 24, 264 BCE	c.1 year + 10 days.	1 am UT= 4 am BLT	p. 67
8	8/IX Nov. 28/ 29, 251 BCE	March 22, 253 BCE	c.2 yrs 8 mths + 7 days	4 pm UT= 7 pm BLT	p. 78
9	2/X Dec. 29, 249 BCE	20 March 250 BC	c.1 yr 9 mths + 9 days	4 pm UT= 7 pm BLT	p. 81
10	4/III June 2/3, 235 BCE	(Ulūlu II) 18 Sept. 237 BCE	c.1 yr 8 mths + 5 days	1 am UT= 4 am BLT	p. 85
12	28/III July 2, 230 BCE	March 20, 231 BCE	c.1 yr 4 mths 18 days	9 am UT= noon BLT	p. 88
13	4/V July 29, 224 BCE	March 24, 226 BCE	c.2 years, 4 mths + 5 days	6 pm UT= 9 pm BLT	p. 91
14	12/VII Oct. 21, 220 BCE	March 18, 220 BCE	c.7 months	3 am UT/ 6 am BLT	p. 95

248 This makes a difference in the moon's zodiac position, and the Julian date. UT (Universal Time) is the equivalent to GMT (Greenwich Mean Time). Babylonian local time (BLT) has been computed for three hours ahead (appropriate to the time-zone east of Greenwich), *BH*, 23–25, 35–36. It will be of interest to readers who wish to compute the moon's zodiac position and check the results with the next table.

TABLE 1.4.2b (*cont.*)

Col 1 BH text no.	Col 2 BHBD	Col 3 NPID	Col 4 Difference	Col 5 Computed Time of Birth	Col 6 BH. Ref.
15	9/XI Feb. 4, 202 BCE	March 21, 204 BCE	c.1 yr 10 mths 17 days	4 pm UT= 7 pm BLT	p. 99
16a	3/III June 5, 200 BCE	March 17, 201 BCE	c.1 yr 2 months 18 days	1.75 UT= 4.45 am BLT	p. 104
16b	14/VII Oct. 31, 199 BCE	(Ulūlu II) Sept. 19, 199 BCE	c.1 month and 12 days	3 am UT= 6 am BLT	p. 103
17	(19?)/VII Oct. 20? 176 BCE*	March 22, 177 BCE	c.1 yr 7 mths	4 pm UT= 7 pm BLT	p. 107
18	6/XII March 1, 142 BCE	17 March, 144 BCE	c.1 yr 11 mths 16 days	3 am UT= 7 am BLT	p. 110
19	13/VI Sept. 7, 140 BCE	(Ulūlu II) 18 Sept., 142 BCE	c.1 yr 11 mths 18 days	4 pm UT= 7 pm BLT	p. 112
20	24/V Aug. 16, 126 BCE	March 20, 128 BCE	c.2 yrs 4 months 26 days	2 am UT= 5 am BLT	p. 115
21	22/VI Oct. 1, 125 BCE	March 17, 125 BCE	c.6 mths 13 days	2 pm UT= 4 pm BLT	p. 120
22a	2/IV July 5, 117 BCE	March 19, 117 BCE	c.3 mths 15 days	2 pm UT= 4 pm BLT	p. 124
23	9/X Jan. 5, 88 BCE	March 21, 90 BCE	c.1 yr 9 mths 14 days	9 pm UT= 12 am BLT	p. 128
26	25/26/V Sept. 4, 76 BCE	March 15, 76 BCE	c.5 mths 19 days	7 pm UT= 10 pm BLT	p. 136
27	20/I April 16, 69 BCE	March 21, 71 BCE	c.2 years 25 days	11.50 am UT= 2.30 pm BLT	p. 140

One would expect the moon's position in the 4Q318 calendar to be behind its position for the corresponding date in the *Babylonian Horoscopes* texts (*BH*) soon after a month had been intercalated because the additional month would push the moon in *4QZodiac Calendar* calendar forwards. I shall term this situation "Easter late," to make the idea easier to conceptualise by comparing the BH Birth Date to a 'moveable feast' echoing the familiar situation when Easter is late in the calendar (in April, in the same year that there has been

an intercalation in the Jewish calendar, so the addition of one month pushes the date of Easter back).[249] Here, the default calendar is *4QZodiac Calendar*. The opposite would be expected to be the case when an intercalary month was due and the moon had fallen behind the Qumran zodiac calendar, then 4Q318 should be one or two days ahead of the horoscope date for the same lunar position. This, I shall call an 'Easter early' situation because it is conceptually similar to when the date of Easter (for example, representing the BH Birth Date in the 4Q318 calendar) is early (in March) because there has not been an intercalation in the Hebrew calendar for two years.

In Table 1.4.2c, **col. 1** gives the *BH* text number in order of the Nearest Previous Intercalation Date (NPID), with no. 1 representing the *BH* text with the most recent intercalation. **Col 2** lists the birth date, BHBD. **Col. 3:** the Moon's Position in the Babylonian Horoscope (BHMP) for the day of birth; this is signified by {C} if the degree has been calculated with modern computation. In **col. 4**, the Moon's Position in 4Q318 (4Q318 MP) is compared with that of the BHBD and the number of days the 4Q318 Calendar Date (CD) is behind or ahead of the BHMP is given. **Col 5**, states the time in days (approximately), months and years from NPID. In **col. 6**, two zodiac positions are itemised: a) the Calendar Date in *4QZodiac Calendar* (4Q318 CD) corresponding with the BHBD and the 4Q318 MP; and in bold: b) the 4Q318 CD and 4Q318 MP corresponding with the BHMP. Finally, **col. 7** states the difference in degrees between the 4Q318 MP and the BHMP for the BHBD.

The pattern that emerges is that up to about a year from the NPID, the moon's position in 4Q318 can be one or two days behind the dates of birth for the corresponding lunar zodiacal position in the Babylonian Horoscopes.[250] Between a year to two years from the NPID, the 4Q318 MP and the BHMP fall on the same days of the month; after about 15 months from the NPID, the date of the BHMP can agree with the MP in the "DS" dates as well as the 4Q318 CD, or it may border either text.[251] The exception is (No. 16) *BH* Text no. 27, which agrees with 4Q318 in the text, but according to modern computation is –10° in error, discussed below. Finally, when the BHBD is more than two years from the NPID it agrees with the MP on those same dates in the DS.[252]

249 The date of Easter is determined by the Hebrew, luni-solar calendar (although the Gregorian calendar is solar), for a concise history, see E.G. Richards, *Mapping Time: The Calendar and its History* (Oxford: Oxford University Press, 1998, reprinted with corrections 2000), 345–353.

250 Nos. 1–6: *BH*: 16b, 22a, 26, 21, 14, 5 (date uncertain).

251 Nos. 7–9, 4Q318: *BH* 16a, 12; Nos. 10–15, 4Q318 and DS: *BH* 17, 10, 9, 23, 15, 18, 19.

252 Nos. 17–19, DS: *BH* 13, 20, 8.

TABLE 1.4.2C *Zodiac position of the moon in* BH *(col 3) compared to dates in 4Q318 (col 6) according to the Nearest Previous Intercalation Date* (NPID) *(col 5)*

Col 1 **BH Text no. in NPID order**	**Col 2** **BH Birth Date (BHBD) 2**	**Col 3** **BH Moon Position {modern computation} (BHMP)**	**Col 4** **Dates of 4Q318 MP to BHBD**
1. Text no. 16b	14/VII	18° Taurus {C}	+2 days behind BHBD 'Easter late'
2. Text no. 22a	2/IV	**5° Virgo {C}**	+1 day behind BHBD 'Easter late'
3. Text no. 26	25/V	**17° Leo {C}**	+2 days behind BHBD 'Easter late'
4. Text no. 21	22/VI	**"Beginning of Leo" {0° Leo}**	+1–2 days behind BHBD 'Easter late'
5. Text no. 14	12/VII	8° Aries	+ 1 day behind BHBD 'Easter late'
6. Text no. 5	[23]?/XII	"10° Aquarius"	+1 day behind?
7. Text no. 16a	3/III	"15° Cancer" {29°Can}	same day {computed value}
8. Text no. 12	28/III	2° Cancer {C}	same day
9. Text no. 17	(19?)/VII	14° Gemini {C}	–1 day before 'Easter early' (?)
10. Text no. 10	4/III	6° Leo {C}	–1 day before 'Easter early'
11. Text no. 9	2/X	"12° Aquarius" {15° Aq}	(Error: +3°} same day {computed}
12. Text no. 23	9/X	"5° Taurus" {3°Tau}	–1 day before 'Easter early'
13. Text no. 15	9/XI	"end of Taurus" 27°Taurus {C}	–2 days before 'Easter early' (DS)
14. Text no. 18	6/XII	3° Gemini{C}	–1 day before 'Easter early'
15. Text no. 19	13/VI	3° Pisces{C}	–1 day before 'Easter early'
16. Text no. 27	20/I	"18° Cap" {28° C}	same day with error +1 day ahead {C} 'Easter late'
17. Text no. 13	4/V	0° Libra {C}	–1 day before 'Easter early'
18. Text no. 20	24/V	25° Gemini{C}	–1 day before 'Easter early'
19. Text no. 8	8/IX	27° Pisces {C}	–1 day before 'Easter early'

Col 5 Distance from NPID	Col 6 a. Same 4Q318 CD and MP. b. 4Q318 CD and same MP in bold	Col 7 4Q318 MP/ BHMP difference in degrees on BHBD
c. 1.4 mths {Ululu II}	14/VII: 19° Aries–2° Taurus; [**16/VII: 15–28°Tau**].	–16°
c. 3.5 mths	2/IV: 13°–26° Leo; [**3/IV: 26° Leo–9°Vir**]	–9°
c. 5.6 mths	25/V: 12°–25° Can. [**27/V: 8°–21°Leo**]	–23°
c. 6.4 mths	22/VI: 3°–16° Can; [**23+24/VI: 16°–29° Cancer+ 29° Can–12° Leo**]	–14°
c. 7 mths	23°Pi–6°Aries [**13/VII: 6°–19° Aries**]	–2°
c. 1 year	[23]?: 16°–29° Cap [**24/XII: 16°Cap–12°Aq**]	–11°?
c. 14.6 mths	3/III: 26° Can–9°Leo **(Error: 2/III: 13°–26° Can)**	{–14° error} {C}Agree 4Q318
c. 16.6 mths	28/III: 21° Gem–4° Can	Agree 4Q318
c. 19 mths	**19?/VII. 24° Gem–7°Can** [**18/VII: 11°–24° Gem**]	(+ 10?) Agrees with DS
c. 20 mths {Ululu II}	4/III: 9° to 22° Leo [**3/ III: 26 Can–9 Leo -1**	Borders both DS and 4Q318
c. 21 mths	2/X: 13° Aq to 26°Aq	Agree 4Q318
c. 21.5 mths	9/X 14°–27° Taurus; [**8/X: 1°–14°Taurus**].	Agrees with DS
c. 22.6 mths	9/XI: 14°–27° Gemini [**7/XI: 14 Gem–27 Tau**]	+ 13° Agrees with DS
c. 23.5 mths {Ululu II}	6/XII: **5°–18° Gem** [**5/XII: 22°Tau–5° Gem**]	Border with both DS and 4Q318
c. 23.6 mths {Ululu II}	13/VI: 6°–19° Pisces [**12/VI: 23°Aq–6°Pi**]	Border with both DS and 4Q318
c. 24.8 mths	20/I: 7°–20° Cap [**21/I: 20°Cap–3Aq**]	(4Q318 agrees with—10° text error)
c. 28 months	4/V: 9°–22° Lib [**3/V: 26 Vir– 9 Lib**]	+ 9° Agrees with DS
c. 29 mths	24/V: 29° Gem–12°Can [**23/V: 16°–29° Gem**]	+ 4° Agrees with DS
c. 32 months	8/IX: 1°–14° Aries [**7/IX: 18 Pi -1 Aries**]	+ 3° Agrees with DS

I will now look at a selection of *BH* texts in more depth in order to illustrate my hypothesis that 4Q318 is useable as an ideal calendar.

(No. 4) Text 21 (BM 33018):[253] 22 Ulūlu (Month VI), Year 127 S.E = 1 October, 125 B.C.E. The moon was in "the beginning of Leo."

NPID: c. 6.4 mths. *BH computation: moon: 00° Leo, sun: 10° Libra.* The text states that the child was born in the 11th hour (c. 5pm), the moon was at the beginning of Leo ("in the head of the Lion" = Normal Star ε Leontis) in the hour of the birth (obv. 4) and the sun was in Libra (obv. 4) (no degree given). The *BH* text states twice that the moon was at 24° Cancer before sunrise on 22 Ulūlu (obv. 3, rev. 6) and at 9° Leo before sunrise on the following day, 23 Ulūlu (rev. 6–7). Therefore, if the ideal lunar motion is 1° per two hours, the moon could be in the early degrees of Leo at the sunset. (The lunar motion would be fast, the moon has travelled about 15° in 24 hours).

4Q318: 22 Elul: 3°–16° Cancer. *BH* has computed for 5 pm, well before the three-quarter moon could have risen. (The date, the 22nd, informs us of the moon's phase). Therefore, at sunset, the border of the next day, 23 Elul, the moon's position in the zodiac in 4Q318 is at 16° Cancer. This is approximately 14° behind the text: 00° Leo (computed) (00° Leo–16° Cancer = 14°). Fourteen degrees is the equivalent to about one day. According to my hypothesis, it would be expected that the Moon's Position (MP) would be a day after the MP in 4Q318 ('Easter late') because the moon is one day ahead in the Babylonian calendar due to the recent intercalation, about 6½ months previously (NPID).

(No. 7) Text 16a (W.20030/10 rev)[254] 3 Simanu (Month III), 113 S.E = June 5, 200 B.C.E., the last part of the night [before sunrise]. Moon, 15° Cancer, sun is in Gemini (no degree given). NPID: c. 14.6 mths. *BH computation for 4.45 am local time is moon: 29° Cancer, sun: 15° Gemini.* There is a lunar degree error in the text of –14°. The lunar data in Text 16a (15° Cancer) agrees with moon's position in the "DS" (Sivan 3: 9°–22° Cancer). The moon would not have been visible when the child was born because it was before sunrise and it would have been an invisible crescent below the horizon (14° from conjunction). However, by modern computation the lunar position in Text 16a was 29° Cancer, thus agreeing with the 4Q318 for the same day of the month (3 Sivan: 26° Can–9° Leo). Hence, after about a year from an intercalation, there is a same day correspondence between 4Q318 and the BH (just over 14½ months from an intercalation {NPID}).

253 Rochberg, *BH*, 117–120; Rochberg-Halton, "Babylonian seasonal hours," 153–160.

254 Rochberg, *BH*, 100–104.

(No. 11) Text 9,[255] (NCBT) 1231 Anu-bēl-šunu: born in the evening of (?) 2 Tebētu (Month X), 63 S.E.= 29 December, 249 B.C.E. The text states that the moon is at 12° Aquarius and the sun at 9.30° Capricorn (line 3, obv.).[256]

NPID: c. 1 yr, 9m 9d. *BH computation, December 29, 249 B.C.E, 7pm: moon: 15° Aquarius, sun 12° Capricorn.* There is a lunar degree error of –3° in the text. Text 9 is a famous horoscope of a well-known court scribe and astrologer, Anu-bēl-šunu, from his own collection in third century B.C.E., Uruk. The moon's position by modern computation, 15° Aquarius, is three degrees behind the text's data. Modern computation agrees with 4Q318 (13°–26° Aq). There is thus a correspondence between the data in 4Q318 and the horoscope using modern computation, some 21 months from an intercalation (NPID).

(No. 16) Text 27[257] (BM 3104) is precisely dated to the 9th hour of 20 Nisannu (Month I), 243 S.E. = April 16, 69 B.C.E., 2.30 pm, Babylonian local time. The moon's zodiac degree in the text is 18° Capricorn, the sun: 30° Aries.

NPID: c. 2 yr 25 d; *BH calculation: moon: 28° Capricorn, sun 28° Aries.* There is a lunar zodiac degree error of –10° in the text. The moon would not have been at all observable at this time (it is a three-quarter moon, which would not rise until late at night). According to the computed error (18° Capricorn in the text instead of 28° Capricorn by modern computation) in the text, 4Q318 would have had a same-day agreement with the BHMP (4Q318: 20 Nisan: 7°–20° Capricorn at sunset). [In other words, 4Q318 agrees with the text, which according to modern computation has an error of 10 deg.]

Although Text 27 has a 2 year-plus NPID, modern computation places the moon in its stated position about 20 hours later (approximately equivalent to 10 deg) in an 'Easter late' position with respect to the Qumran text (4Q318, 21 Nisan: 21° Cap – 3° Aq). The birth-date is less than a year from the next intercalation on March 17, 68 B.C.E,[258] so the moon has not slipped behind the calendar. This finding would suggest that the ideal calendar of 4Q318 has a wider margin of error is some years.[259] On the other hand, the large error by the ancient astrologer also requires some explanation.

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255 Rochberg, *BH*, 79–81; Beaulieu and Rochberg, "The Horoscope of Anu-bēl-sunu," 91, 92.

256 Other texts giving fractions of solar degrees are also from Uruk: Texts 5.3 and 10.3: Rochberg, *BH*, 80.

257 Rochberg, *BH*, 137–140; Rochberg-Halton, "Babylonian Seasonal Hours," 160–162.

258 Chris Bennett, "Babylonian and Seleucid Dates," online, http://www.tyndalehouse.com/Egypt/ptolemies/chron/babylonian/chron_bab_anl.htm.

259 The DS is 2–3 days behind (at 22–23 Nisan, commencing at 20° Sagittarius on 20 Nisan). Thus, this text does not conform to the general pattern.

Finally, Table 1.4.2d, below, places the above data in a bar-chart format, aligning the dates that the moon is in the same zodiac sign or thereabouts in 4Q318 in relation to the horoscope dates. The chart is arranged beginning with the most recent intercalation date, NPID, in descending chronological order. Dates that the moon's ideal position in 4Q318 progress from +2 days ahead ["Easter early"] to –2 days behind ["Easter late"] the calendar of the Babylonian horoscopes are expressed by darkening shades of grey. It begins with the lightest: for +2 days behind ["Easter late"], (No. 1) *BH* Text no. 16b.

TABLE 1.4.2d *4Q318 dates according to the zodiac position of the moon in* BH

No.	BH Text no.	Behind ("Easter	Behind late")	Same Date	Ahead ("Easter	Ahead early")
01	16b					
02	22a					
03	26					
04	21					
05	14					
06	5					
07	16a			{C}	(error)	
08	12					
09	17					
10	10					
11	9					
12	23					
13	15					
14	18					
15	19					
16	27		{C}	(error)		
17	13					
18	20					
19	8					
		+2 days Late	+1 day Late	0 Same date	–1 day Early	–2 days Early

Summary of Table 1.4.2d

The Table shows that there was a +2 **day 'Easter late'** result with *BH* Texts 16b, 26 and 21. The **NPID** respectively for those horoscopes were about: **1.4 months; 5.6 months; and 6.4 months** earlier.

There was a +1 **day 'Easter late'** result with *BH* Texts 22a and 14. The **NPID** respectively for those horoscopes were about: **3.8 months and 7 months** earlier. (*BH* Text 27, discussed above does not follow the same pattern and is problematic).

There was a **same-date** correspondence with *BH* Texts 5, 16a, 12, and 9. The **NPID** for those horoscopes were about **1 year; 14.6 months; 15 months and 21 months** earlier. (The astronomer-astrologer made an error with *BH* Text 16a, noted above).

There was a –1 **day 'Easter early'** correspondence with *BH* Texts 17, 10, 23, 18, 19, 13, 20 and 8. The **NPID** respectively for those horoscopes were about **19 months; 20 months; 21.5 months; 23.5 months; 23.6 months; 28 months; 29 months; and 32 months** earlier.

There was a –2 **day 'Easter early'** result for *BH* Text 15 where the NPID was about **22.6 months** earlier. The last intercalation prior to the NPID for *BH* Text 15 (BM 36796) was nearly three years beforehand.[261] The horoscope date was just seven weeks from the next calendrical intercalation.

The key factor in this comparative exercise was that degrees were superimposed onto *4QZodiac Calendar*, thereby permitting a closer examination of the relationship between the ideal scheme in the Qumran text and the Seleucid calendar in the Babylonian horoscopes. It was pointed out that, in Rochberg's opinion, ephemerides were employed in the Babylonian horoscopes that contained the zodiacal degrees of the sun, moon and planets, but that the form of these tables was unknown. It has been demonstrated here that some of the lunar birth-time data in the Babylonian horoscopes could have been extracted from ideal 360-day zodiac calendars. This suggestion does not rule out the premise that a range of different sources was used to compile the data collected in all these horoscope texts, particularly as the tablets were composed at later dates, sometimes years subsequent to the birth event.[261]

It has been shown here that in 18 of 19 texts examined, the lunar zodiacal position can be calibrated from the ideal schematic calendars to within a few degrees when related to the distance in time from the last intercalation. In one case (No. 7) *BH* Text 16a, *4QZodiac Calendar* agreed better with modern computation than the ancient astrologer's calculations. Yet in another tablet, (No. 16) *BH* Text 27, the reverse was the case: the ancient astrologer's calculations agreed with the ideal calendar of 4Q318, but according to modern computation both were in error. As far as the Qumran brontologion is concerned

260 9/XI (9th of the 11th month) SE (Seleucid era) 109 = Feb. 4, 202 B.C.E. The NPID was March 21, 204 B.C.E., and the previous NPID was March 24, 207 B.C.E.

261 Rochberg, *Heavenly Writing*, 105; Beaulieu and Rochberg, "Horoscope of Anu-Bēlšunu," 90.

all that was required to compute the prognostication was the date giving the moon's zodiac sign.

The results shown above would suggest that in order to achieve this, the user would still need a knowledge of the specific sequences of intercalation, whatever they were for 4Q318, but it would not be necessary to calculate the degree of the moon in the zodiac. (Unlike a horoscope, the position of the moon in the brontologion has no mantic relationship to the five classical planets and its angle from the sun is known from the calendar date, as well as by its shape, which explicates its phase, so it is not necessary to state the degrees of the sun and moon in the text).

In summary, the 360-day ideal calendars of *4QZodiac Calendar* and the "Dodekatemoria scheme," although ideal, have a relationship with a version of the 19-year cycle of the standard Babylonian calendar. All but one of the horoscopes produced a pattern of results that one would expect if those lunar zodiac calendar schemes were based on a cycle of regular intercalation. The results support Britton's contention that the 360-day calendar is self-regulating.[262] As predicted, 4Q318 appears to be an ideal zodiac calendar biased towards dates about one year to two years after an intercalation has taken place. If it were to be used for the brontologion, the user would need to know the sequences of regular intercalations and the last previous intercalation date as determined by the date of the nearest solstice or equinox in order to obtain the correct results. The tablets reflecting the Uruk scheme show such data. If that knowledge was in place, it should be possible to use the ideal calendar of 4Q318 for the appropriate years for omens where all that was needed for a prediction was the moon's sign of the zodiac on a given date in the zodiac calendar.

It has also been shown that 4Q318 is related to the 360-day Late Babylonian 'Dodekatemoria scheme.' Brack-Bernsen and Steele suggest that the 'Dodekatemoria scheme' was "meant to be astrologically convenient rather than astronomically accurate."[263] I would add that, if the last previous intercalation date was taken into account there might have been more than one version of the scheme as an arithmetical aid, such as the Aramaic calendar found at Qumran. The basic paradigm could possibly have been used in slightly different formats to obtain the ideal lunar zodiacal position for different luni-solar years in the 360-day year calendar. If no such scheme is discovered among other cuneiform texts, then we may suggest from its find spot that *4QZodiac Calendar* was a possible Jewish adaptation of a Babylonian text. It is apparent that *4QZodiac Calendar* is a variant of the late Babylonian 360-day zodiac calendar which is connected with the 19-year cycle of the 354/384-

262 Britton, "Calendars, Intercalations and Year Lengths," 117, as noted in §1.4.

263 Brack-Bernsen and Steele, "Babylonian Mathemagics," 104.

day Babylonian calendar standardised in the reign of Cyrus in the fifth century B.C.E., according to Britton.

The main point of this very detailed exercise has been to demonstrate that *4QZodiac Calendar* is closely connected with late Babylonian astrology and that it is a useable zodiac calendar. To achieve a wide span of predicted results in a small, varied sample suggests that this is a fruitful area of research. As a further test to explore the possible viability of 4Q318 as a handy ideal zodiac calendar that belongs in a Jewish context, this comparative experiment continues with the Hebrew calendar in use today.

1.4.3 *4Q318 and the Rabbinical Calendar*

The history of scholarship on the relationship between the Babylonian calendar and the rabbinical calendar in use today is not as straightforward as one might suppose. While most scholarship on the Jewish calendar focuses on the different stages of its development, the possible relationship between the 360-day Babylonian zodiac calendar and the rabbinical calendar has not been considered in modern scholarship. This sub-section will argue that *4QZodiac Calendar* may be a missing link in current research on the history and ancient background of the Jewish calendar. It puts forward the suggestion that it is another Jewish calendar—it has the same month names, and follows a similar calendrical cycle—to the rabbinical calendar. (I prefer to describe it as "another," rather than a "variant").

Stern notes that the "rabbinic calendar" was not the only Jewish calendar although rabbinic sources make the assumption that it was.[264] Rather than viewing the zodiac in Jewish contexts as an aberration, or a problem from a modern, rationalist Western perspective, we may need to consider the Jewish zodiac calendar from an emic viewpoint, to borrow the term from anthropology; that it could, but not necessarily, have a divinatory function and that it was kept apart from the Babylonian-Jewish civil-festival calendar in some contexts because it could be used for a different purpose. Thus, it probably did not constitute a diverse stage in the development of the rabbinical calendar but was a calendar adopted by Jews nonetheless.

Segal had suggested that the ancestor of the rabbinical calendar moved from lunar observation during the Exile, to a semi-computed scheme by the second century C.E.; it was fixed in the fourth century C.E. and reached its final form after the system of postponements, the *dehiyyot*, were finally resolved in the tenth century C.E.[265] With respect to the Babylonian civil calendar, Wacholder

264 Stern, *Calendar and Community*, 156.

265 J.B. Segal, "Intercalation and the Hebrew Calendar," *VT* 7 (1957): 305–306. For a summary of the modern postponements, see A. Spier, *The Comprehensive Hebrew Calendar* (New

and Weisberg compare intertextual similarities between the Talmud and astronomer-astrologers' reports to the Assyrian kings of the sighting of the first crescent. They conclude that the early Mishnaic lunar calendar based on new crescent visibility was related to the Neo-Assyrian method of determining the month-length by observation.[266] They further contend that the later, pre-calculated rabbinical calendar is similar to the later Babylonian system of astronomical pre-calculation:

> The Talmud still appears to preserve the older system of observation of the lunar crescent, if we may take the written record as reflecting actual procedure. It would seem, therefore, that the system of calendation preserved in 1st or 2nd century rabbinic texts [that is, by observation {my addition}] preserves a system which was in use before 481 B.C.E. [that is, determining the beginning of the month by observation of the lunar crescent in Babylonia {my addition}] and continued in use even after a new one was introduced in Babylonia. The Talmudic system [that is, the later pre-calculated system {my addition}] could not have been adopted until—at the earliest—359 C.E., and possibly as late as the seventh century of the Christian era.
>
> The post-exilic calendar as presented in the Talmud [the system of observation {my addition}] was thus inconsistent with that of the cuneiform tradition in Babylonia after 481 B.C.E. [the pre-calculated system {my addition}]; though bearing many resemblances, the two systems diverged until at least several centuries into the present era.[267]

The relevant point here is that Wacholder and Weisburg linked the different stages of the rabbinical calendar from astronomical observation to schematic, pre-calculated months and years with the corresponding development of Babylonian calendrical astronomy: from lunar crescent sighting to mathematically predicted months in the same diachronic sequence but separated by centuries. This chronologically-stepped sequential narrative mirrors the

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York: Feldheim, 1986), 15: the rules of the modern rabbinical calendar means that month-lengths, and hence year lengths are precalculated so that Yom Kippur (Tishri 10) does not fall on Friday or Sunday, the day before or after the Sabbath and Hoshana Rabba (Tishri 21) does not fall in the Sabbath. For a historical outline, see S. Stern, "The Origins of the Jewish Calendar," *Le'ela* 44 (1997): 2–5. For an in-depth historical view, Stern, *Calendar and Community*, 155–283.

266 Wacholder and Weisburg, *Visibility of the New Moon*, 2–8, Table 1, p. 6. The main chronological periods of the system of determining the months are described in Steele, "The Length of the Month," 133–149, see § 1.4.

267 Wacholder and Weisburg, *Visibility of the New Moon*, 239.

theoretical model that there was also a link between the mathematically interesting ca. fifth to second century B.C.E. Babylonian '*Kalendertexte*,' and *4QZodiac Calendar*, which was either copied or composed at the turn of the Common Era from cuneiform, or Aramaic.

Depuydt places the astronomical basis of the fixed Hebrew calendar to between the third century B.C.E. and the end of the tenth century C.E.[268] Based on Albiruni's account of the Hebrew calendar, written in 1000 C.E., and the mathematical agreement between Hebrew and Hipparchan astronomy,[269] he suggests that there were three possible directions of cultural transmission for the present form of the rabbinical calendar. These were: a) from the Jewish presence in Babylonia in late antiquity; b) from the Jewish community in Alexandria, where Ptolemy wrote the *Almagest* in c. 150 C.E.; and, c) from medieval Judeo-Arabic scholarship which studied Arabic translations of Greek astronomy that were being produced in the eighth and early ninth centuries C.E. He adds that most scholars today believe that the last option c) is the most probable context for the final stage of the development of the rabbinical calendar.[270]

We might infer that all these routes may have been relevant for the development of the final form of the rabbinical calendar, but that stage (a) may have been the path taken for the transmission of the *4QZodiac Calendar* from Mesopotamia; and that 4Q318 did not merge and develop with the proto-rabbinic calendar in stages (b) and (c). The zodiac calendar's purpose is different; it is not interested in preventing particular festivals from occurring on or around the Sabbath and festivals, concerns which apparently affected the growth of the rabbinic calendar.[271]

Stern casts doubt on the authenticity of the presupposed historical tradition that the Hebrew calendar incorporating the 19-year cycle was fixed prior to the medieval period.[272] He rejects the commonly held belief that the rabbinical calendar was instituted by Hillel the Patriarch in 358/9 C.E. on the basis that the evidence is neither attested in contemporary rabbinical sources nor unequivocally in late medieval sources.[273] Stern argues that the development

268 Depuydt, "History of the *ḥeleq*," 97.

269 Depuydt, "History of the *ḥeleq*," 79, 85, 91, 92–94, 97–98, 102–103.

270 Depuydt, "History of the *ḥeleq*," 97.

271 Stern, *Calendar and Community*, 165–168.

272 Stern, *Calendar and Community*, 176, 180, 196–200.

273 The tradition is repeated in Spier, *The Comprehensive Hebrew Calendar*, 2: "In the fourth century, however, when oppression and persecution threatened the continued existence of the Sanhedrin, the patriarch Hillel II took an extraordinary step to preserve the unity of Israel . . . In accordance with this system, Hillel II formally sanctified all months

of the rabbinical calendar occurred gradually, rather than by a single ruling.[274] He develops the evidence for the long-running scholarly debate that the fixed, pre-calculated rabbinical calendar was still not fully place in the ninth century C.E., demonstrating that observation of the lunar crescent still played a role in determining month-lengths during this period and that a "fixed calendar of full and defective months in alternation was also used in this period, according to the Tosefta, whenever the new moon had not been sighted."[275] In line with the conclusions of earlier scholarship, Stern describes how the rabbinical calendar in use today did not reach its final form until the tenth century.[276]

Thus, there is no reason to rule out the suggestion that a Jewish zodiac calendar with the same Aramaic-Babylonian month names as that which became the rabbinical calendar was preserved in another strand of Judaism by a group who may not have been proto-Rabbinites, and that the paths diverged; or, the zodiac calendar co-existed with the proto-rabbinical calendar in the same circles. Stern admits:

> ... the origins of the present-day rabbinic calendar are extemely unclear. After more than a century of scholarly research, greatly enhanced by discoveries in the Cairo Genizah, the history of the rabbinic calendar in the first millennium CE, and particularly from the post-Mishnaic to the later Geonic periods, remains shrounded in mystery.[277]

Stern believes that the authority to determine the month could be decided by competing rabbinical courts, city councils with the jurisdiction to set the calendar, or individual rabbis who were also vested with calendrical influence, thereby "leading at times to calendrical diversity."[278] From our point of view, the absence of a single monopolistic calendrical authority (according to Stern) meant that calendrical multiplicity could flourish. 'Calendrical multiplicity' means that more than one calendar was able to exist within the same Jewish

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in advance, and intercalated all future leap years until such time as a new, recognised Sanhedrin would be established in Israel."

274 Stern, *Calendar and Community*, 175–179.

275 Stern, *Calendar and Community*, 180.

276 Stern, *Calendar and Community*, 180–182, 184–185, 191–196. For a summary of important earlier scholarship and research on these questions dating back to the 19th century, see Stern, *Calendar and Community*, 155–156; Depuydt, "History of the *ḥeleq*," 96–97.

277 Stern, *Calendar and Community*, 155.

278 Stern, *Calendars in Antiquity*, 347–348.

circles endogomously, notwithstanding the idea that calendrical plurality, that is, different calendars used by separate groups, could also be tolerated.

Calendrical plurality, or diversity, is recorded as having existed between the rabbanites and the Karaites during the medieval period;[279] although anachronistic, we could regard that situation as having precedents in antiquity. A zodiac calendar unconcerned with Sabbaths and festivals would not be in conflict with separate groups who measured their months by different methods. It could be a pre-proto-rabbinical calendar or part of a multiple-calendar culture interested in astrology and the interpretation of omens that crossed group boundaries. Indeed, the ancient world had a variety civil calendars and astrological calendars (see Chapter 5). Interestingly, Olszowy-Schlanger refers to polemics whereby the pre-calculated rabbinical calendar was said to be computed with "the charms of sorcerers and astrologers," by foundational Karaite leaders in the late ninth, early tenth centuries (the Karaites determined the months by lunar observation).[280] So, counter-intuitively from some modern scholars' perspectives who argue that astrology is forbidden in Judaism, the early medieval rabbinical calendar was regarded in some Karaite quarters as being tainted by astrologers.

As noted elsewhere there is an element of modern scholarship that believes that Jews in antiquity did not practise astrology, and, that therefore, 4Q318 must be Hellenistic. Pointing to tradition history again, there is a wealth of documents to show that astrology was actively practised by leading rabbis in the medieval period so much so that the subject was a political issue and rabbis who engaged in astrology, particularly electional astrology, the method of which was recorded by Ibn Ezra, were challenged, although not repudiated, by Maimonides.[281]

The previous sub-section demonstrated that the 360-day ideal zodiac calendar at Qumran and in Babylonia could be used with, and was related to,

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279 J. Olszowy-Schlanger, *Karaite Marriage Documents from the Cairo Genizah: Legal Tradition and Community Life in Medieval Egypt and Palestine* (Leiden: Brill, 1997), 248–250.

280 Olszowy-Schlanger, *Karaite Marriage Documents*, 249, and n. 12.

281 S. Sela, *Abraham Ibn Ezra and Elections, Interrogations and Medical Astrology* (Leiden: Brill, 2011). S. Sela, "The Fuzzy Borders between Astronomy and Astrology in the Thought and Work of Three Twelfth Century Jewish Intellectuals," *Aleph* 1 (2001): 59–100; S. Sela, "Astrology in Medieval Jewish thought (Twelfth to Fourteenth Centuries)," in *Science in Medieval Jewish Cultures* (ed. Gad Freudenthal; Cambridge: Cambridge University Press, 2012), 292–300; Y. Tzvi Langermann, "Maimonides' Repudiation of Astrology," in *Maimonides and the Sciences* (ed. R.S. Cohen and H. Levine; Dordrecht: Kluwer Academic Press, 2000), 131–157; A. Marx, "The Correspondence between the Rabbis of Southern France and Maimonides about Astrology," *HUCA* 3 (1926): 311–358.

the civil 354/384-day Babylonian calendar. If the rabbinical; calendar was originally related to the Babylonian calendar there may be a relationship between *4QZodiac Calendar* and the rabbinical calendar. There are a number of points of contact: the month names of the Babylonian months and those found in 4Q318, Byzantine Palestinian synagogue zodiacal mosaics (En Gedi and Sepphoris),[282] early Jewish calendars and the rabbinical calendar are the same. According to the Jerusalem Talmud, "They carried the names of the months back with them from Babylonia."[283] See Table 1.4.3 for the list of Babylonian month names and the Aramaic translations used in Jewish calendars.[284]

TABLE 1.4.3 *Month names in the Assyrian and Babylonian Calendar, and the (Jewish) Aramaic versions*[285]

Month order	Assyria/Babylonia	Jewish	Seasonal period
I	Nisannu	Nisan	March/April
II	Ayyaru	Iyyar	April/May
III	Simānu	Siwan	May/June
IV	Du ūzu	Tammuz	June/July
V	Abu	Ab	July/August
VI	Ulūlu	Elul	Aug./Sept.
VI_2	Ulūlu šanu		
VII	Tašritu	Tišri	Sept./Oct.
VIII	Arahsamna	Marcheśwān	Oct./Nov.
IX	Kislīmu	Kislēw	Nov./Dec.
X	Tebētu	Tēbēt	Dec./Jan.
XI	Sabātu	Šebāt	Jan./Feb.
XII	Addaru	Adar	Feb./Mar.
XII_2	Addaru šanû	Adar (II)	Feb./Mar.

282 See also §1.5. *The zodiac sign-names* in 4Q318 and §1.6. *The Babylonian-Aramaic month names*.

283 *y. Rosh HaShanah* 1.56d.

284 Most of names were also adopted by the Nabateans, the Palmyreans and the Syrians, D. Herr, "The Calendar," in *The Jewish People in the First Century*. 2 vols. (ed. S. Safrai and M. Stern; CRINT 1; Assen: Van Gorcum; Philadelphia: Fortress, 1976), 2:836–837.

285 Adapted from J. Boardman et al. (ed.), "Note on the Calendar," *Cambridge Ancient History.* vol. 3, part 2 Cambridge: Cambridge University Press, 1992), 750; R. Rochberg-Halton, "Calendars: The Babylonian Calendar," *ABD*, 1: 812. The Aramaic month names were found in the En Gedi and Sepphoris Byzantine synagogues (with corresponding zodiac signs).

The 19 year cycle of the modern rabbinical calendar has seven intercalations in a different order to the Babylonian 19-year cycle, the embolistic (intercalary) months occur in the 3rd, 6th, 8th, 11th, 14th, 17th and 19th year of the cycle.[286] Embolistic (leap) years may be 383, 384 or 385 days long when an embolistic month is intercalated in a "defective" year of 353 days, or a "regular" year of 354 or an "excessive" year of 355 days.[287] Both calendars have 29-day and 30-day months. The Babylonians used 29 or 30-day months that occurred in irregular sequences; the 29 day months were called "hollow" months and the 30-day months were called "full" months, based theoretically on the observation of the lunar crescent as well as mathematical formulae.[288] The rabbinical calendar uses a calendrical structure of schematic, pre-fixed regular alternating pairs of 29 and 30-day months with a similar terminology; the 30-day month is translated as "abundant" and the 29-day month, "defective."[289] In a common year, Adar, the 12th month, has 29 days.[290] In an embolistic year, Adar I is the intercalary month and it consists of 30 days; Adar II has 29 days.[291] Alternating 29 and 30-day months are not known in Babylonia; however, a similar scheme of schematic, pre-fixed 59-day alternating "double months" was known in ancient Greece, described by the first century B.C.E. scientific writer, Geminos; a 30-day month is "full" and a "hollow" month has 29 days.[292] Twenty-nine and

286 Spier, *The Comprehensive Hebrew Calendar*, 14 §10.

287 The leap years takes on the same terminology as the common (non-embolistic) years, Spier, *The Comprehensive Hebrew Calendar*, 15 § E 13.

288 Lis Brack-Bernsen, "Methods for understanding and reconstructing Babylonian predicting rules," in *Writings of Early Scholars in the Ancient Near East, Egypt, Rome and Greece: Translating Ancient Texts* (ed. Annette Imhausen and Tanja Pommerening; Berlin: de Gruyter, 2010), 277–298 (esp. 285).

289 Spier, *The Comprehensive Hebrew Calendar*, 14 § B 7. See also Stern, *Calendar and Community*, 192–193.

290 Spier, *The Comprehensive Hebrew Calendar*, 14 (§7), also see 15 (§13.a.b.c [non-embolismic year lengths]): Tishri: 30 days; Heshvan: 29/30 days; Kislev: 29/30 days; Tevet: 29 days; Shevat: 30 days; Adar 29 days; Nisan 30 days; Iyyar 29 days; Sivan 30 days; Tammuz 29 days; Av: 30 days; Ellul 29 days.

291 Spier, *The Comprehensive Hebrew Calendar*, 15 (§13.d.e.f [embolismic year lengths]). Stern, *Calendar and Community*, 193.

292 J. Evans and J. Lennart Berggren, *Geminos's Introduction to the Phenomena* (Princeton, NJ: Princeton University Press, 2006): VIII 3, 34, pp. 176, 176 nn. 3, 4, 191; R. Hannah, *Greek and Roman Calendars: Constructions of Time in the Classical World* (London: Duckworth, 2005), 29; B.D. Merritt, *The Athenian Year* (Berkeley: University of California Press, 1961), 35. For an alternative (minority) view refuting Geminos, see W.K. Pritchett and O. Neugebauer, *The Calendars of Athens* (Cambridge, MA: Harvard University Press, 1947), 13–14.

30-day months are also attested in the *Aramaic Book of Enoch* at Qumran, 4Q209 frag 26.[293]

In Babylonia, according to Rochberg, the 19-year cycle had a fixed order of embolistic years in the 1st, 3rd, 6th, 9th, 11th, 14th and 17th year that began in the Achaemenid period and lasted through the Seleucid and Arsacid eras until the end of cuneiform tradition (so Britton, above). The first year of the 19-year cycle had an intercalary Ulūlu, the other intervals had an additional Addāru.[294] These differences together with the rabbinical postponements, when the beginning of a month is postponed to avoid certain festivals falling on certain days of the week[295] are the sum of the divergences between the rabbinical and Babylonian calendars.

It has just been shown that there is a connection between the Babylonian horoscopes and *4QZodiac Calendar*. The question now is whether there is a traceable mathematical and astronomical relationship between 4Q318 and the rabbinical calendar. By comparing the position of the moon in the zodiac on the same dates in both calendars, the ancient schematic lunar-zodiac-solar date and the rabbinical lunar-solar date, we should be able to see whether a relationship exists, or whether the rabbinical calendar has moved away from what is here suggested are its related origins. This enquiry is now investigated.

1.4.3.1 The Rabbinical Calendar Tested with 4Q318

As shown earlier, *4QZodiac Calendar* is a variation of the schematised 354/384-day Babylonian calendar. However, thus far, any interaction between 4Q318 and the contemporary rabbinical calendar has not been proved. First, an explanation for this investigation is demanded given that the consensus view and mathematical logic would intuitively suggest that the two would not be related given that the rabbinical calendar has a large number of fixed rules, even if it may be historically based on the Babylonian calendar (an historical tenet which is neither conformed nor denied in Jewish calendar scholarship). The two logical objections to this methodology are, that, 1) No link has been proved mathematically to show that the rabbinical calendar is, in fact, descended from the Babylonian calendar, and even it were, it must be far removed from it by now; and, 2) The rabbinical calendar probably does not have anything to do with the moon's position in the zodiac, which in any case has moved in 2,000 years due to the precession of the equinoxes.[296]

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293 See §3.3.1. The 354-day year in 4Q209 fragment 26.

294 F. Rochberg, "Astronomy and Calendars in Ancient Mesopotamia," *CANE*, 3:1938.

295 Stern, *Calendar and Community*, 192, 194–195.

296 The westwards motion of the stars caused by the changes in the direction of the earth's axis of rotation, discovered by Hipparchus in c.150 BCE means that 0° Aries is now in

In response to the first issue, *4QZodiac Calendar* offers an opportunity to see if there is any connection between the rabbinical calendar and the Babylonian, since we have just seen that 4Q318 is related to the Seleucid calendar with respect to the Babylonian horoscopes. With regards to the second issue, it is understood that the tropical zodiac (beginning at the vernal point of 0° Aries) is not in the same position as it was 2,000 years ago, due to the precession of the equinoxes. However, following Ptolemy, modern western ephemerides and astrologers ignore astronomical reality and treat the tropical zodiac as if the stars were in the same place as they were according to Ptolemy's calculation for his era in the *Almagest*.[297] This is convenient for this research because it means that modern ephemerides are documenting the position of the sun, moon and planets in the zodiac about 150 years from when 4Q318 was produced, which in terms of precession is about 2° behind the Qumran text. This would make little difference to the moon's zodiac sign on particular dates.

The tables below begin on Adar 14 because historically Adar 14 was a significant date for declaring whether a month should be embolistic in the observed, Jewish calendar of antiquity. Of particular interest is whether there is any relationship between the moon's position in the 4Q318 calendar and the pattern of intercalations in the rabbinical calendar and if so, whether these might be similar to this study's findings with respect to Babylonian horoscopes.

As recorded in the Mishnah, Adar 14, Purim, was in pre-Talmudic times the cut-off date in Adar before which an intercalation could be declared; this rule was later extended to include the remainder of Adar.[298] An announcement would be made in the synagogue on Adar 14 concerning the calendar, and if an embolistic month were declared, the reading of the scroll of Esther would take place a month later on Adar 14 II (a 29-day month) (see Table 1.4.3) and Adar would become Adar I (with 30 days instead of 29 days).[299]

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the constellation of Pisces, the apparent movement of the fixed stars is about 1° every 72 years, see *Astronomy before the Telescope*, 344; Neugebauer, *HAMA*, 55–54, 298, 631; Rochberg, *Heavenly Writing*, 128; according to Neugebauer the Babylonians did not recognise precession because their zodiac was sidereally fixed, the year was defined with respect to the sun's apparent return to a fixed star, Rochberg, *Heavenly Writing*, 132; O. Neugebauer, "The Alleged Babylonian Discovery of the Precession of the Equinoxes," *JAOS* 70 (1950), 1–8.

297 G.J. Toomer, *Ptolemy's Almagest* (London: Duckworth, 1984); J. Tester, *A History of Western Astrology* (Woodbridge: Boydell Press, 1987, repr. 1996), 71; N. Campion, *A History of Western Astrology.* Vol. 1: *The Ancient World* (London: Continuum, 2008), 216.

298 *Eduyyot* vii 7; J.B. Segal, "Intercalation and the Hebrew Calendar," *VT* 7 (1957), 297 n. 2.

299 *Meg* i 4; Segal, "Intercalation and the Hebrew Calendar," 297–298; J. van Goudoever, *Biblical Calendars* (Leiden: Brill, 1961), 93.

An earlier Hebrew calendar based on lunar observation represented in the Talmud appears to give Adar 30 days in a regular year.[300] The early Jewish discussion referred to above relates to whether an embolistic month could be declared on Adar 30 because if the new crescent were seen the date would be Nisan 1. In the modern rabbinic calendar Adar in a common year has 29 days.

Chart 1:1 and Chart 1:2: 14 Adar—Virgo. (*4Q318 viii, 2*)

In *4QZodiac Calendar* on 14 Adar (February–March) the full moon is in Virgo on its last day in the sign (19° Virgo–2° Libra) (see Table 1.4.1b, p.97). The moon's position in the zodiac (using astrologers' ephemerides that are based on the zodiac position in Ptolemy's time),[301] is given for modern dates in a common year in Chart 1:1, see below. Although *4QZodiac Calendar* col viii does not include a 13th, leap month, Chart 1:2, the intercalary month, 14 Adar II, stating the moon's position in the zodiac on Adar II, the intercalary month, is produced out of interest. Since there are only seven leap years in a 19-year-cycle, Chart 1:2 covers 10 consecutive leap years in order to obtain a wider view with which to compare the results of Chart 1:1.

Chart 1:1: Testing the 19 year cycle for 14 Adar in the rabbinical calendar from 1991 to 2009 against the data in 4Q318, it was found that the moon had entered Virgo by the end of the day in 14 of those years on that date and was still in Leo on other dates. In five of the years the moon was still in Leo: 1995, 1997, 2002, 2005, 2008, albeit, in four of the five years, the moon was outside Virgo by just a matter of a few hours, from the 'cusp' of Virgo (1997, 2002, 2005, 2008). In those years the modern rabbinical calendar's slippage against the moon's position in the zodiac can be seen. In one year (1995) the moon in Leo on Adar 14 in Adar I was more than one day away from entering Virgo. That year clearly highlights the requirement for an intercalary month if the moon's position in the zodiac was used to calibrate the calendar.

The seven intercalary years (Adar I) are: 1992, 1995, 1997, 2000, 2003, 2005, 2008. In four of the years the moon is still in Leo at the end of the day on 14 Adar including the year identified above as needed an intercalation (1995), they are: 1995, 1997, 2005 and 2008. The moon is less than five degrees from Virgo in the non-intercalary year on 14 Adar (about 28° Leo at the end of the day in 2002).

The moon's degree is given for 6pm (timed for Jerusalem/Jericho) at the end of 14 Adar, roughly estimated, on the presumption that day begins and ends after sunset in 4Q318. According to *4QZodiac Calendar*, the moon on 14 Adar in

300 Segal, "Intercalation," 296 n. 1, *Sanhedrin* 12b, *Berakhot* 10b.

301 Using AC.

Chart 1:1 14 Adar and 14 Adar I*		**Chart 1:2 14 Adar II**	
4Q318 14 Adar (19° Virgo–2° Libra)		**(within range in bold) (19° Vir–2° Lib)**	
		24/25 March, 1986	**15°–28° Virgo♦**
		20/21 March, 1989	**11°–24° Virgo♦**
28 Feb. 1991	24° Leo–8° Virgo		
18 Feb. 1992*	19° Leo–4° Virgo	18/19 March, 1992	**27° Virgo–10° Libra•**
7 Mar. 1993	21° Leo–4° Virgo		
25 Feb. 1994	17° Leo–6° Virgo		
14 Feb. 1995*	2°–15° Leo	15/16 March, 1995	**7°–20° Virgo♦**
5 Mar. 1996	6°–19° Virgo		
21 Feb. 1997*	12°–25° Leo		
		22/23 March, 1997	**15°–28° Virgo•**
12 Mar. 1998	4°–16° Virgo		
2 Mar. 1999	3°–16° Virgo		
20 Feb. 2000*	0°–14° Virgo		
		20/21 March, 2000	6°–19° Libra •
9 Mar. 2001	3° –18° Virgo		
26 Feb. 2002	13°–28° Leo		
16 Feb. 2003*	17°Leo–1° Virgo		
		17/18 March, 2003	**16°–29° Virgo•**
7 Mar. 2004	13°–26° Virgo		
23 Feb. 2005*	17°–29° Leo		
		24/25 March, 2005	**20° Virgo–3° Libra•**
14 Mar. 2006	8°–22° Virgo		
4 Mar. 2007	9°–21° Virgo	20/21 March, 2008	**17° Virgo–0° Libra•**
20 Feb. 2008*	12°–26° Leo		
10 Mar. 2009	0°–14° Virgo	19/20 March, 2011	**27° Virgo–10° Libra•**

Data for sunset 6pm (Jericho time) at the end of the day, thus latest time.

• Data for sunset 6pm (Jericho time) at the beginning of the day, thus earliest time

♦ Data for sunset 6pm (Jericho time) at the end of the day, thus latest time

Virgo should be in the very last degrees of that sign since it is on the third day of the sign. This would be possible if the moon entered Virgo at the end of the day on Adar 12. In only one year, in 2004, was that the case: the moon was at 26° Virgo at the end of the day of Adar 14.

Chart 1:2: In nine out 10 years, the moon was in Virgo but only in three of those years (2003, 2005, 2008) was the moon in the 4Q318 position for Adar 14, sunset to sunset. There had been an intercalation three years before 2003 and 2008 and two years prior to 2005. I could not discern a clear pattern apart from the fact that the moon was, on the whole, deeper in Virgo on 14 Adar II, than on the twelfth month in a common year, Adar 14, or Adar I.

In one embolistic year (2000), the calendar was more than a day behind the moon's position in 4Q318 at first sunset ('Passover late'), showing the moon not in Virgo at all but in Libra (the next sign) from sunset to sunset; the last intercalation being three years ago. The moon's position in the calendar was also behind Adar 14 in 4Q318 in two other years at first sunset, 1992 and 2011 ('Passover late'); in both these cases the last intercalations were three years ago.[302]

Conversely, in 1995 the moon's position in the calendar was ahead of the 4Q318 datum and was early. The best fit lunar degree of Virgo at the beginning of 14 Adar II was in 2003, 2005 and 2008, respectively three years, two years and three years from an intercalation. There seems to be no difference, therefore, if an intercalation occurred at intervals of two or three years previously; it was the intercalation itself that was significant. The moon was not in the latter degrees of Virgo at the beginning of 14 Adar II or 14 Adar I in any of the years in Chart 1.1. The results would suggest that *4QZodiac Calendar* is useable with the rabbinical calendar and that it is biased towards ideal embolistic years in the rabbinical calendar.

Chart 1.3 looks at 4Q318 col vii line i, where the 13th and 14th Tevet (December/ January) are in the zodiac sign of Cancer, the the dates of the full moon in the middle of the lunar month corresponding to the sun in Capricorn. Mid-lunar month the zodiac sign of the moon is opposite the sun in the opposite zodiac sign of Capricorn (the 10th sign of the zodiac which corresponds with December/ January); "13 and 14 Tevet" are extant on the scroll. When the Babylonian ideal degrees of 13° per-day intervals are applied, commencing the calendar with the moon at 0° Taurus, as per Table 1.4.1b, the moon's 4Q318 position is 13 Tevet (6°–19° Cancer) and 14 Tevet (19° Cancer–2° Leo). The degrees are timed from the beginning of the day at sunset to sunrise on, Tevet 13 and from sunrise to sunset on Tevet 14 to test the time of day reckoning. Cols. 1–4 list the Moon Position (MP); they are shaded where these are close to the 4Q318 MP in Table 1.4.1b. See below Chart 1.3 for the discussion.

302 In 2011 and 2000, embolistic years, Passover occurred on April 19 and 20 respectively. In 2009 and 2007, non-embolistic years, Passover occurred on April 9 and April 7 respectively.

CHART 1.3 (*4Q318 vii i*): 13.14 *Tevet: CANCER*

	4Q318			
	13 Tevet (6°–19° Cancer)		**14 Tevet (19° Cancer–2° Leo)**	
Date	**13 Tevet 4.45pm (Moon's Position)**	**13 Tevet 6am (+ 6–7°+)**	**14 Tevet 6am (+ 12–13°+)**	**14 Tevet 4.45pm (+ 5–6°+)**
1992/NPI 10 mths				
6–8 Jan. 93	21° Gemini	28° Gemini	(11°) Cancer	(18°) Cancer
NPI 22 mths				
27–29 Dec. 93	20° Gemini	26° Gemini	(7°) Cancer	(13°) Cancer
NPI 34 mths				
16–18 Dec. 94 E	8° Gemini	14° Gemini	(27°) Gemini	(3°) Cancer
1995/NPI 10 mths				
5–7 Jan. 96	12° Cancer	18° Cancer	0° Leo	6° Leo
NPI 22 mths				
23–25 Dec. 96 E	18° Gemini	24° Gemini	7° Cancer	13° Cancer
1997/ NPI 10 mths				
11–13 Jan. 98	7° Cancer	15° Cancer	28° Cancer	4° Leo
NPI 22 mths				
1–3 Jan. 99	4° Cancer	12° Cancer	26° Cancer	2° Leo
NPI 34 mths				
22–24 Dec. 99 E	28° Gemini	(6°) Cancer	(19°) Cancer	(15°) Cancer
2000/ NPI 10 mths				
8–10 Jan. 2001	1° Cancer	(7°) Cancer	(20°) Cancer	(26°) Cancer
NPI 22 mths				
28–30 Dec. 01	13° Gemini	20° Gemini	(3°) Cancer	(9°) Cancer
NPI 34 mths				
18–20 Dec. 02 E	13° Gemini	19° Gemini	1° Cancer	(7°) Cancer
2003/ NPI 10 mths				
7–9 Jan. 04	16° Cancer	23° Cancer	5° Leo	11°Leo
NPI 22 mths				
25–27 Dec. 04 E	23° Gemini	29° Gemini	(12°) Cancer	(18°) Cancer
2005/ NPI 10 mths				
13–15 Jan. 06	14° Cancer	21° Cancer	3° Leo	(9°) Leo
NPI 22 mths				
3–5 Jan. 07	13° Cancer	20° Cancer	4° Leo	(10°) Leo
NPI 34 mths				
22–24 Dec. 07 E	10° Gemini	19° Gemini	4° Cancer	10° Cancer
2008/NPI 10 mths				

CHART 1.3 (*cont.*)

	4Q318			
	13 Tevet (6°–19° Cancer)		**14 Tevet (19° Cancer–2° Leo)**	
Date	**13 Tevet 4.45pm (Moon's Position)**	**13 Tevet 6am (+ 6–7°+)**	**14 Tevet 6am (+ 12–13°+)**	**14 Tevet 4.45pm (+ 5–6°+)**
9–11 Jan. 09 *NPI 22 mths*	28° Gemini	(4°) Cancer	(17°) Cancer	(23°) Cancer
30 Dec. 09–1 Jan. 10 *NPI 34 mths*	24° Gemini	1° Cancer	Cancer 16°	Cancer 23°
20–22 Dec. 2010 E ***2011****/NPI 10 mths*	19° Gemini	27° Gemini	11° Cancer	(17°) Cancer
8–10 Jan. 2012 (*NPI 22 mths*)	9° Cancer	17° Cancer	0° Leo	6°Leo
26–28 Dec. 2012	15° Gemini	(22°) Gemini	(5°) Cancer	(12°) Cancer

Col. 1 gives the Gregorian dates converted to the rabbinical calendar for 13–14 Tevet from 1993 to 2012. Each date is preceded by the time distance from the Nearest Previous Intercalation (NPI), that is, the last Adar II. Embolistic years in the rabbinical calendar marked here with an 'E' mean that the intercalation is going to take place in the following Adar II, and that 13–14 Tevet that year is therefore either 34 months or 22 months from the NPI.

Col. 2 states the actual computed MP for sunset, 4.45pm, Jerusalem/ Jericho, 13 Tevet.

Col. 3 states the actual MP for sunrise, at 6am, 13 Tevet, about 13 hours later. Not all the MPs have been computed in the next columns as they may be calculated schematically to achieve a rough MP. As the moon travels an ideal 1° per two hours, in 13 hours it will have travelled c.6–7°+ from its starting point given in col. 2. These estimates are in parentheses).

Col. 4 states the actual MP for sunrise at 6am, 14 Tevet, some 24 hours later. The schematic formula for the moon is that it travels c.13° per day, so c.13° degrees can be added on from the previous column. These estimates are in parentheses.

Col. 5. Gives the actual MP for sunset at 4.45pm for 14 Tevet, about 11 hours from sunrise, so c.5–6°+ degrees can be added into the previous MP. Estimated MPs are given in parentheses.

When the actual zodiac position of the moon for the beginning of the day at sunset for 13 Tevet, was computed for Jerusalem over 19 years in the rabbinical

calendar (1993–2012), ignoring precession, as discussed in the previous subsection, the actual Moon's Position (MP) coincided closely with the ideal MP for *sunrise* 14 Tevet (MP: 2° Leo) in five years (1996, 2004, 2006, 2007, 2012).

Two other ideal MPs of 2° Leo on 14 Tevet occurred at the end-of-the day-*sunset* on 14 Tevet, possibly reflecting a sunset-to-sunset day reckoning (1998, 1999). The ideal MPs all occurred about 10 months from the Nearest Previous Intercalation (NPI), that is Adar II in March,[303] and two ideal MPs occurred in a row following an embolistic year that constituted the second year after an embolistic year,[304] thus 10 months and 22 months from the Nearest Previous Intercalation ((NPI) (1998, 1999, at sunset, and 2006, 2007 at sunrise).[305]

Hence, the years marked 'E' mean that the moon has slipped behind the calendar, for example, in 14 Tevet 1996 (December 25) at sunset the moon has reached 13° Cancer. In Chart 1:2, it may be seen that there was an Adar II in March 1997, the intercalation at the end of the same year. In the luni-solar calendar, this pushed 14 Tevet forward by a month to 13 January 1998, so that date did not occur in December 1997, but in January 1998. On 13 January 1998, the MP was at 4° Leo at sunset, in Jerusalem, agreeing with the ideal Babylonian degree for 14 Tevet.

Switching attention to 13 Tevet: the day begins ideally when the MP has reached 6° Cancer, again the MP matched this degree at sunset in 1998 and 1999 and was ahead or behind in other years following an embolistic year, as with Tevet 14. Since over the 19 years, there are agreements for both sunrise-to-sunrise day reckoning and sunset-to-sunset day reckoning, at this stage in the research it may be better not to draw firm conclusions about the time of day reckoning in 4Q318. Variables may include the different times of year.

Chart 1.4: The date of 14 Nisan in the rabbinical calendar is examined below; taking the computed position of the moon in the zodiac, again, as of 2,000 years ago timed for noon, Jericho/Jerusalem,from 1994 to 2013 (without precession or mathematical adjustments for the earth's rotation). In the Tishri-to-Tishri rabbinical calendar, the years indicated with an 'E' mean there had been an Adar II in the previous month to Nisan of the same year. The Babylonian degrees for 14 Nisan: Libra in *4QZodiac Calendar* (see Table 1.4.1b) are **19° Libra to 2° Scorpio**. The MP here is taken for noon and the ideal lunar position from the Qumran text that agree closely with those MPs are shaded.

303 As shown in Chart 1:2.

304 See §1.4, type (3) year.

305 The NPID and NPI are approximate rules of thumb, rather than specific dates and the precise intervals from those dates. The year of the NPID (March) and the NPI are marked in col. 1 in Chart 1:3.

CHART 1.4 (*4Q318. recon*). *14 Nisan: LIBRA*

4Q318

14 Nisan: (19° Libra–2° Scorpio)	
Date	**14 Nisan at noon (Moon's Position)**
26 March 1994	21° Virgo
14 April 1995 E	9° Libra
3 April 1996	6° Libra
21 April 1997 E	14° Libra
10 April 1998	9° Libra
31 March 1999	4° Libra
19 April 2000 E	7° Scorpio
7 April 2001	8° Libra
27 March 2002	17° Virgo
16 April 2003 E	20° Libra
5 April 2004	15° Libra
23 April 2005 E	20° Libra
12 April 2006	1° Libra
2 April 2007	9° Libra
19 April 2008 E	18° Libra
8 April 2009	3° Libra
29 March 2010	29° Virgo
18 April 2011 E	2° Scorpio
6 April 2012	11° Libra
25 March 2013	10° Virgo

E Embolistic year, reckoned from Tishri-to Tishri; Nisan immediately follows an Adar II in the same year

Although 14 out of 19 dates coincide with Libra, thereby showing an agreement between 4Q318 and the the rabbinical calendar, the more precise rule-of-thumb position of the moon is more complex. In a *sunset-to-sunset* day reckoning (using Table 1.4.1b) beginning 14 Nisan with the moon at 19° Libra, taking the real-time of a 7.30 pm sunset and a 6.30 am sunrise for that month (for Jericho/Jerusalem), means the moon would reach c.**24°–25° Libra** at *sunrise* (that is, about 11 hours later, calculating for 1 lunar degree per two hours from 19° Libra, thus adding 5°–6°). The moon would then be at c.**26.30° to**

27.30° Libra at *noon* (2°–3° lunar trajectory in about five and a half hours from 6:30 am), and **0°–2° Scorpio** at *sunset* at 7:30pm (about 4° in seven and half hours from noon, and 13° in 24 hours). There are no years in Chart 1:4 in which the moon is positioned at c.26.30° to 27.30° Libra at midday.

However, three years out of 19 years agree with a possible *sunrise-to-sunrise* day reckoning (2003, 2005, 2008, shaded). If one takes the moon at 19° Libra at sunrise, it would reach **c.21° Libra** by *noon*, c. 25° Libra by sunset, c.27° Libra by midnight and about 1 Scorpio by sunrise next day. There is also a sunrise-to-sunrise day reckoning agreement with 14 Tevet, in Chart 1:3 for these three years. The general pattern that emerges in Chart 1:4 is that the moon is furthest into the zodiac on dates in intercalary years in the rabbinical calendar (particularly 2000, and 2001), but that not all intercalary year dates have the moon in a later degree (1995), even though they are all "late Passover" dates.

The moon is less advanced in the zodiac on the latest Passover date, 23 April 2005 E (20° Libra at noon), than on earlier "late Passover dates" when the moon is in a more extreme behind position, such as 19 April 2000 E (7° Scorpio at noon), and 18 April 2011 E (2° Scorpio at noon). In a sunset-to-sunset day reckoning the 23 April 2005 E date would commence at around 11° Libra, about 8° *ahead* of the ideal degree of 19° Libra for the beginning of the day. The 2005 Passover constitutes the second year following an embolistic year, which in the case of 14 Adar I (Chart 1:1) pushed the moon to the latest position in the zodiac calendar.

The mathematics of the calendar in relation to *4QZodiac Calendar* seemed to have a more defined pattern with the Babylonian horoscopes, than with the rabbinical calendar and the results were different, possibly because of the order of intercalary months. The closest comparison between Chart 1:4 and the Babylonian horoscopes is with Text 16b in which the birth-date was one month after an intercalation and 30° *behind* the position of the moon for the same date in 4Q318 (the MP was at 18° Taurus, but the day began in 4Q318 at 19° Aries).

We do not know when the 19-year-cycle in the rabbinical calendar began, since there is no Elul II as a cycle marker. In the Babylonian system it is possible that there was an 'ideal year' in the cycle from which some years deviate more than others and which would be understood from the data in the Uruk scheme. In so far as *4QZodiac Calendar* is connected with the rabbinical calendar, the relationship with the intercalary years *per se* was the most significant with respect to Nisan 14: five out seven results in Chart 1:4 fell into the 19° Libra to 2° Scorpio window, the signs of the full moon for that month depending on whether an intercalary month had been added in the month previously. It could be argued that when one compared *4QZodiac Calendar* with the

rabbinical calendar by examining the moon's position in the zodiac that it was an ideal calendar that was "designed for eternity."[306]

In summary, this section found that *4QZodiac Calendar* was an Aramaic variant of the Babylonian 'Dodekatemoria scheme,' a mathematical conundrum in the *Kalendertexte* tablets, as deciphered by Brack-Bernsen and Steele. When *4QZodiac Calendar* was compared with the 'Dodekatemoria scheme' and applied to the birth date and zodiacal moon positions in Babylonian horoscopes compiled by Rochberg, it was found that that it was biased towards ideal years in the Babylonian calendar that were embolistic. It demonstrated that the Qumran calendar was useable with the Babylonian horoscopes within these limitations and that one could identify a predictable mathematical process.

The empirical investigation also produced results with the rabbinical calendar that showed an agreement with the moon's position in the zodiac as of 2,000 years ago with embolistic years in this calendar as well. However, the details of the findings between the comparative exercises were different. It is here suggested that *4QZodiac Calendar* is an ideal calendar. This is the first time that a mathematical connection has been demonstrated between the Babylonian and the rabbinical calendar. The rabbinical calendar in use today is not completely removed from the Qumran Aramaic zodiac calendar, as one would have expected. It was also noted that astrology was practised by rabbis in the medieval period and that it was a controversial political issue. Furthermore, it was observed that early leaders of the Karaites, compared the rabbinic calendarists to astrologers. It is possible, therefore, that the zodiac may have been part of the Jewish calendar at some point in its history.

The next section is devoted to an exploration of the textual components of *4QZodiac Calendar*: an analysis of the names of the signs of the zodiac, the Aramaic numerals and the Aramaic-Babylonian month names, with reference to other Dead Sea Scrolls. This examination may help to define the intellectual context of *4QZodiac Calendar* within the culture of Second Temple Judaism.

306 I thank Christopher Walker for confirming that there was probably an ideal year which was used to measure differences in other years. In his view, 4Q318 was "pure Babylonian" and belonged to a zodiac scheme that was "designed to work forever." This is indeed what the empirical results in this and the previous sub-section suggest. Private conversation after my presentation on 'The Zodiac Calendar in the Dead Sea Scrolls (4Q318) in Relation to Babylonian Horoscopes,' at The Jews and the Sciences, British Association of Jewish Studies annual conference, University College London, June 2012, which Dr Walker kindly attended at my invitation.

1.5 The Zodiac Sign Names in 4Q318

The sign names in the Qumran Aramaic zodiac are a rich source of chronological and cultural information about the process of the transmission of zodiacal astrology and astronomy to Judea. The background to significant sign names in the Qumran zodiac will now be analysed in order to explore whether there were any distinctive elements to the zodiac of 4Q318 compared to zodiacs in the surrounding cultures, and if so, what the variants may have meant within the context of Qumran and Second Temple Judaism.

Fortunately, at least one example of each sign-name survived in 4Q318 cols. iv, vii, viii and so there is a complete set of the names of the signs of the zodiac. The scroll contains the earliest extant zodiac in Aramaic in a material primary source. The Qumran zodiac predates the earliest Hebrew zodiacs, which are witnessed in Byzantine Palestinian synagogue mosaics, by at least 300 years.[307] Two of the surviving Byzantine synagogue zodiacs, En Gedi, which is inscriptional, and Sepphoris, which is iconic, connect the months of the year with the corresponding signs of the zodiac.[308] 4Q318 is the earliest witness to this practice in a Jewish source and context.

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307 See bibliographic summary in R. Hachili, *Ancient Mosaic Pavements* (Leiden: Brill, 2009), 35–56: Hammath-Tiberias, fourth century; Sepphoris, pl. III.2; fifth–sixth century; Huseifa, late fifth century, fig. III.1; Beth Alpha, sixth century, pl. II.3; Na' aran sixth century, pl. III.4a; En Gedi, late sixth century, pl. III. 4c. D. Barag and Y. Hirschfeld date the Stratum II synagogue from the mid-5th century to the destruction at the end of the 6th to early 7th centuries, in D. Barag, "The Synagogue at Ein Gedi," in *Ein Gedi. A Very Large Village of Jews* (ed. Y. Hirschfeld; Haifa: Hecht Museum, 2006, 18–19), and R. Hachlili, *Archaeology and Art: New Discoveries and Current Research* (Leiden: Brill, 2013), 346–373; R. Hachlili, "The Zodiac in Ancient Jewish Synagogal Art: A Review," *Jewish Studies Quarterly* 9 (2002): 219–258. The Hammath-Tiberias zodiac mosaic belongs to the Stratum IIa synagogue, which was in use throughout the 4th century from the earliest pre-Byzantine date of 286 to the latest date of 396–422 C.E., the Stratum IIa synagogue was probably rebuilt after the earthquake of 306 C.E. during the reign of Constantine (306–337 C.E.), M. Dothan, *Hammath Tiberias: Early Synagogues* (Jerusalem: IES, 1983), 67–70, 45–49, pls. 16, 25–26, 29, 32–33.

308 At En Gedi the names of the months follow the names of the signs of the zodiac in separate panels of text. See D. Barag et al., "The Synagogue at Ein Gedi," in *Ancient Synagogues Revealed* (ed. L.I. Levine; Jerusalem: IES, 1981), 116–119. In the Sepphoris zodiac wheel, the sign name comes before the corresponding month name in four panels, Taurus, Libra, Scorpio and Sagittarius, and they are reversed in Pisces, with the month Adar coming first, but this appears to be an adaptation to the space available, Hachili, *Ancient Mosaic Pavements*, 44, fig. III.9 (37–38, 40–44, figs, III–3b, III–4b, III–6, III–7, III–8, III–9). Z. Weiss, *The Sepphoris Synagogue: Deciphering an Ancient Message through its Archaeological and*

In *4QZodiac Calendar* the sign names are as follows: תורא, The Ox;[309] תאומיא, The Twins;[310] סרטנא, The Crab;[311] אריא, The Lion;[312] בתולתא, The Maiden;[313] מוזניא, The Balance;[314] עקרבא, The Scorpion;[315] קשתא, The Bow or The Archer;[316] גדיא, The Kid-Goat;[317] דולא The Bucket;[318] נוניא, The Fishes;[319] דכרא, The Ram.[320] As Greenfield showed in his seminal study on the etymological basis of the sign names, the Qumran zodiac is not entirely the same as the Greek, Akkadian, Hebrew, or the Eastern Aramaic Mandaic and Syriac zodiacs.[321] The use of particular sign names may assist us in determining the period that the original version of *4QZodiac Calendar and Brontologion* took its attested shape as found as Qumran.

Greenfield suggested that Aramaic played an intermediary role in the transmission of the zodiac sign names, conjecturing that a Greek scholar within

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Socio-historical Contexts (Jerusalem: Israel Exploration Society; Institute of Archaeology, University of Jerusalem, 2005), 104 (Band 5); 105 (fig. 46), 106 (fig. 47), 108 (fig. 49), 109 (fig. 50), The 12 zodiac signs, names and months: 110–123; Schwartz conjectures that the "juxtaposition of names of the months and zodiac signs at Sepphoris may have been meant to facilitate its use as a horoscopic aid." (S. Schwartz: *Imperialism and Society*. Princeton, NJ: Princeton: University Press, 2000), 176; see also pp. 172–173; 175–176; 180–181; 187–188. Hachili suggests that ancient synagogue mosaics represent an ancient liturgical calendar, *Ancient Mosaic Pavements*, 48, 54–56, 230–232. She refutes the suggestion that the zodiac could have been simply decorative, due to the repetitive nature of their use (*Ancient Mosaic Pavements*, 56). Similarly, Fine puts the case that the zodiac is related to Jewish liturgy, and argues that the use of Hebrew connects the mosaics to a synagogue-based liturgical tradition (S. Fine, *Art and Judaism in the Greco-Roman World* [Cambridge: Cambridge University Press, 2005]), 196–205 n. 101. See also L. Ness, "Astrology and Judaism in Late Antiquity" (Ph.D. diss. University of Miami, 1990), Ch. 5. Cited 29 September 2012. Online: http://www.smoe.org/arcana/diss5.html.

309 4Q318 vii 5, viii 1; this sign name is also extant in 4Q186 1 ii 8 (Popović, *Reading the Human Body*, 28–29), the only other zodiac sign in the Dead Sea Scrolls outside of 4Q318.

310 4Q318 col. viii line 9.

311 4Q318 col. vii lines 1, 6; col. viii line 2.

312 4Q318 vii 1, 6, viii 2.

313 4Q318 vii 2, viii 3.

314 4Q318 vii 2, 7.

315 4Q318 vii 2, 7.

316 4Q318 vii 3, 8, viii 4.

317 4Q318 iv 9, 8, viii 4.

318 4Q318 vii 4, 9, viii 5.

319 4Q318 vii 4, 9, viii 5.

320 4Q318 viii 1, 6.

321 J.C. Greenfield, "The Names of the Zodiacal Signs in Aramaic and Hebrew," in *Au Carrefour des Religions* (ed. R. Gyselen; RO 7; Bures-sur-Yvette: GPECMO, 1995), 95–103.

the Achaemenid court, or scholarly contacts in the coastal cities of Asia Minor, enabled the dissemination process.[322] This cosmopolitan theory neatly accounts for the mixture of cultural traditions in the Qumran zodiac, but not entirely for the variant sign names.

Historically, the zodiac itself, as opposed to the zodiacal constellations, which are older, is attested in the fifth century B.C.E. in astronomical diaries from Mesopotamia in the and horoscope tablets from the late fifth century B.C.E.[323] It appeared in Greece in the zodiacal calendar of Euctemon (fl. 432 B.C.E.), Meton (fl. 432 B.C.E.), and Eudoxus (c.390 B.C.E.–340 B.C.E.).[324] Each culture retained its own sign names, some of which overlapped while other zodiacal names represented different motifs. Over time, some names were exchanged in both directions. There may be traces of this exchange and replacement process in the Qumran zodiac before the Hebrew and Eastern Aramaic zodiacs became fixed. There is no visual imagery in the Qumran zodiac (nor in any of the Dead Sea Scrolls); in contrast, zodiacs before and contemporary with 4Q318 are rich in iconography and literary *topoi*, which may place particular cultural interpretations on sign names from Greece and the ancient Near East that are not reflected in the etymologically.

4QZodiac Calendar has the earliest attested variant zodiac sign-names for Capricorn and Aquarius, which differ from both the Akkadian and Greek; these same variants appear in later Hebrew, Syriac and Mandaic sources. Later Syriac, Mandaic and Arabic texts also have different sign names for Virgo, Sagittarius, Gemini and Pisces[325] that are not extant in Hebrew, or at Qumran.

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322 Greenfield, "The Names," 96.

323 Britton argues for a date of c. 400 B.C.E., in J.P. Britton, "Studies in Babylonian Lunar Theory: Part III. The Introduction of the Uniform Zodiac," *Arch of the Hist of the Exact Sci* 64 (2010): 617–663 (date: 618, 649) and against B.L. van der Waerden, "History of the Zodiac," for a slightly earlier date. Sachs, "Babylonian Horoscopes," 54–55; Rochberg, *Heavenly Writing*, 130–131 n. 27, 28, 29 maintains that in Seleucid era texts *ina* "in," *ina* SAG "the beginning of," and *ina* TIL "at the end" followed by a the name of star always to refer to a zodiac sign, not a constellation and that two Babylonian horoscopes, *BH* 5:5 and 9:5 report positions for Jupiter "at the beginning" of a zodiac sign.

324 Bowen and Goldstein, "Meton of Athens and Astronomy in the Late Fifth Century B.C.," 52–63; Neugebauer, *HAMA*, 628–629.

325 P. Gignoux, "Les noms des signes du zodiaque en syriaque et leurs correspondants en moyen-perse et mandéen," in *Mélange Antoine Guillaumont* (ed. R.G. Coquin et al.; Geneva: Patrick Cramer, 1988), 200–304; I thank Dr Christa Müller-Kessler for her talk and handouts related to the Mandaic zodiac and Mr Nicholas al-Jeloo for his paper related to the Syriac zodiac, presented at the ARAM Society 29th international conference on Astrology in the Ancient Near East, Oriental Institute, Oxford, 8–10 July 2010; see also

One of the most important features of the differences between the zodiacal names in 4Q318 and its Greek and Mesopotamian antecedents is that the Qumran zodiac nomenclators do not denote any creatures which would be abominable in biblical law, namely those which would contravene Lev 19:19, the proscription against the uniting of two different species. I shall now discuss a few sign-names in 4Q318 of particular interest, which taken together, make the Qumran zodiac unique.

Aries is the only zodiac sign that was not directly translated into Hebrew in the Hebrew zodiac . In 4Q318, Aries is The Ram, דכרא,[326] as it is in the Greek zodiac, Κριός, Ram. The Hebrew equivalent is a Lamb, טלה, attested in the ancient Palestinian synagogue zodiac mosaics.[327] The Lamb is also the name of the zodiac sign of Aries in Mandaic.[328] The Mesopotamian name is the Hired Man, HUN.GA (Akkadian: Agru).[329] Van der Waerden and Wallenfels observed that The Ram replaced the Hired Man in the late Mesopotamian tradition.[330] As published by Wallenfels, the image of a Ram is found in mid-second century B.C.E. Mesopotamian seal impressions; no iconography of a Hired Man, or a Lamb, on seals are known.[331] Sachs notes that the sign mul-LU or múl-LU, or LU, "meaning 'Aries' " ["hired man"][332] appears in more than a dozen Seleucid texts.[333] All the other sign names in the Hebrew zodiac are equivalent to direct translations of the Aramaic zodiac in 4Q318. The sign names in the Hebrew zodiac extant today are identical to those of the Byzantine Palestinian synagogue zodiacs.

The sign name for Virgo in 4Q318 is The Virgin, בתולתא,[334] a direct translation of the Hellenistic name for the sign, Παρθένος, Virgin. Greenfield comments

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Roland Laffitte, "Les noms des signes du zodiaque dans l'espace arab-turco-persan et méditerranéen." *Bulletin de la Selefa* 7 (2006): 1–12. Cited July 15 2010. Online: http://www.selefa.asso.fr/files_pdf/Instit07_T8.pdf.

326 4Q318 vii 5, viii 1, 6, see Greenfield and Sokoloff, DJD 36, 262–263, pl. 15.

327 R. Hachili, *Ancient Mosaic Pavements*, 40–41 (pl. III.7a; fig. III–6); טלה is clear in all the synagogue mosaics, except Huseifa, where no names are extant.

328 Greenfield, "The Names," 98.

329 Hunger and Pingree, *MUL.APIN*, 69, 138.

330 Wallenfels, "Zodiacal Signs," 282–283; van der Waerden, "History of the Zodiac," 226; Greenfield, "The Names," 98.

331 Wallenfels, "Zodiacal Signs," 282–283, see no.1, fig. 1; van der Waerden, "History of the Zodiac," 226.

332 Hunger and Pingree, *MUL.APIN*, for example, 50 (Tablet 1 iii 24); L. Bobrova and A. Militarev, "From Mesopotamia to Greece: to the Origin of Semitic and Greek Star Names," in *Die Rolle der Astronomie in den Kulturen Mesopotamien*s, 321.

333 A. Sachs, "Babylonian Horoscopes," 71 n. 51.

334 4Q318 vii 2, viii 3, see Greenfield and Sokoloff, DJD 36, 262–263, pl. 15.

that in many ways this is "most interesting of the zodiacal names" at Qumran, and that it is the only "concrete sign of Western influence among the zodiacal names in the Jewish tradition."[335] If it had been Babylonian influenced, we could expect the zodiacal name to be The Ear of Corn, שבתלתא, as it is in a similar form in the Eastern tradition.[336] Neither the Greco-Roman tradition nor the Qumran or Hebrew zodiacs adopted the Mesopotamian name for this sign: an ear of corn, representing Spica, the fixed star that the Virgin appears to hold in the constellation of Virgo (α Virginis).[337] Interestingly, the Hebrew name for Spica is שבתלת, an Ear of Corn, as it is in other Semitic languages.[338] In cuneiform texts and MUL.APIN, the name has multiple levels: the Furrow, and the Ear of Corn of the Goddess Shala, or Barleystalk: ^{mul}AB.SíN.[339] The sign may be represented by Ishtar holding a long weapon and a bunch of dates in a third millennium B.C.E. Babylonian wax impression.[340] In the astrological tablet AO 6448 (the top of Text 2b in the *Gestirn Darstellungen* tablets, from early second century B.C.E. Uruk, a young woman, facing left, carries an ear of corn in her right hand.[341] Her ankle-length skirt is drawn in at the waist; the hem and skirt have a detailed pattern. According to Caplice, this is possibly the first example of iconic Greek influence for this sign in Mesopotamia.[342] Van der Waerden does not agree that this particular image stems from Greek influence, but he concurs that the Greek name of Virgo may not have a Babylonian source and that the representation of an ear of grain is of Mesopotamian origin.[343] Similar imagery of a female figure holding an oversized spike of grain, representing Spica is found for a graphic representation of Virgo on a seal from Seleucid

335 Greenfield, "The Names," 99–100.

336 Greenfield and Sokoloff, DJD 36, 267–269 (at 268); Greenfield, "The Names," 99–100.

337 Greenfield, "The Names," 99–100; Aratus, *Phaenomena* (ed. and trans. D. Kidd; Cambridge: Cambridge University Press, 1997), line 97 (lines 96–98) pp. 79–81, commentary, pp. 215–216; Ptolemy, *Tetrabiblos* (Robbins, LCL), 51 n. 5; Manilius, *Astronomica* 5.270–292 (Goold, LCL), 322–325; Laffitte, "Les noms," 8–9; *Geminos's Introduction to the Phenomena* II.6 (trans. Evans and Berggren; Princeton, NJ: Princeton University Press, 2006), 137–138, n. 6; Greenfield and Sokoloff, DJD 36, 267–269 (at 268). So in Syriac and Mandaic.

338 Bobrova and Militarev, "From Mesopotamia to Greece," 314.

339 Van der Waerden, "History of the Zodiac," at 226; Hunger and Pingree, MUL.APIN (Tablet I iv 31–37): 67–69 (at 68), (Tablet I ii 10–13), 33; Hunger and Pingree, *Astral Sciences*, 71; Greenfield, "The Names," 99; Bobrova and Militarev, "From Mesopotamia to Greece," 314.

340 J.H. Rogers, "Origins of the Ancient Constellations: I: The Mesopotamian Traditions," *JBAA* 108.1 (1998): 9–28 (11, fig. 2, 26). Cf. H. Hunger states that such representations need not have any astronomical significance, online: HASTRO-L, January 16, 2011.

341 E. Weidner, *Gestirn-Darstellungen*, 9–11, 29–34, pl. 10.

342 R. Caplice, review of E. Weidner, *Gestirn-Darstellungen, Or* 38 (1969), 580–582 (at 581–582).

343 Van der Waerden, "History of the Zodiac," 226.

Uruk dated to 217 B.C.E.[344] The impression on the gem apparently portrays a standing woman facing left, dressed in an indistinct garment, without a headdress, holding the large ear of wheat in her right hand. According to Wallenfels, the spike of Spica represents the constellation of Virgo.

The Mesopotamian artists' iconic representations of the sign-name may have played a determining role in the literary transmission, from Sheaf of Grain in the ancient Near East, to *Parthénos* in Greece, and thence to *Betulat'* at Qumran.[345] Laffitte argues that due to Hellenistic influence this Qumran zodiac sign name should be classified as Western Aramaic.[346] The pictorial representation of the Hebrew Virgo, בתולה, in early Byzantine Palestinian synagogue mosaics appears as a woman both with and without an ear of grain,[347] possibly reflecting both the Western (Hellenistic) and Eastern (Babylonian, Hebrew) traditions, although, as stated above, there may be similar female representations of Ishtar. The sign of Libra, the Scales, or the Balance, מוזניא,[348] is a name of Babylonian origin that was adopted by the Greeks:[349] Ζυγὸς, eventually replacing their name for Libra, the Claws (of the Scorpion), Χηελαι.[350] The

344 R. Wallenfels, "Zodiacal Signs among the Seal Impressions from Hellenistic Uruk," in *The Tablet and the Scroll* (ed. M.E. Cohen et al.; Bethesda, MD: CDL Press, 1993), 281–289 (285, no. 6, fig. 8).

345 Greenfield, "The Names," 100.

346 Laffitte, "Les noms," 8–9.

347 At Sepphoris, only two ears of wheat and a star (all extant zodiac signs in this roundel have stars) remain; at Hammath Tiberias Virgo is an elaborately fully-clothed woman wearing a veil at the back of head, tunic, robe and jewellery, holding a torch in her right hand; at Na'aran, Virgo holds a plant; and at Beth Alpha, Virgo is a bejewelled, decoratively attired Byzantine princess on a throne without a plant. See Hachili, *Ancient Mosaic Pavements*, pl. III. 8c; fig. III–7, 42.

348 4Q318 vii 2, 7, viii 3, see Greenfield and Sokoloff, DJD 36, 272–273, pl. 15. It is spelt with a *vav* as the second letter in 4Q318. In Hebrew it is spelt with an *aleph*: מאזניא. At Hammath Tiberias, Sepphoris and Na'aran, *Moznayim* is spelt with a *vav* (Heb.) At Beth Alpha it is spelt with an *aleph* (the sign is not extant at Huseifa), see Hachili, *Ancient Mosaic Pavements*, 42.

349 *Geminos's Introduction* (trans. Evans and Berggren), 117 n. 12.

350 The so-called Geminos Parapegma (dated to shortly after 200 B.C.E.) uses the Balance or the Scales Ζυγὸς (Lehoux, *Astronomy, Weather and Calendars in the Ancient World*, 227); Geminos (fl. c.50 B.C.E.) refers to the Balance and attributes the Claws to "the ancients," *Geminos's Introduction* (trans. Evans and Berggren), 117, n. 12 (vii 25); Manilius uses both "Libra," and "Chelae" the Balance and Claws, see use of both in one verse: *Astronomica* 4.547–8 (Goold, LCL).

Akkadian tradition knows The Scales, ZI.BA.AN.NA,[351] The Beam or Balance of a scale.[352] The sign name, ΧΗΕΛΑΙ, the Claws of the Scorpion, is inscribed in the world's oldest known geared machine, the Greek Antikythera Mechanism,[353] dated variously to circa 150 B.C.E and 80 B.C.E.[354] Kidd agrees that the Balance entered the Greek zodiac only after Hipparchus (c.190–c.120),[355] but Goold dates the adoption of *Zygós* and *Libra* into Hellenistic astronomy and the Greco-Roman literary world to no earlier than the first century C.E.[356] If so, and The Scales in 4Q318 was originally imported through later Hellenistic influences, it may mean that the origin of Libra at Qumran may be not dated before the beginning of the first century C.E. On the other hand, if the Qumran Libra came from Mesopotamia, the origin of this sign name in the Dead Sea Scrolls could have been earlier. In all the extant Hebrew synagogue mosaics, Libra is

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Zugós (ζυγός) is attested in the zodiacal sundials (S.L. Gibbs, *Greek and Roman Sundials*, New Haven, CN: Yale University Press), 86; Philo uses the Balance, see Philo, *Creation* 39:116 (Colson and Whitaker, LCL); Ptolemy (fl. c.150 C.E.) uses both sign names in the *Tetrabiblos* (Robbins, LCL), 51 n. 2, but in the *Almagest* he uses The Claws in the text and the Balance in his headings, except once in the text with reference to a "Chaldean" observation (*Almagest* ix 7), see *Geminos's Introduction* (trans. Evans and Berggren), 117 n. 12.

351 Hunger and Pingree, *MUL.APIN*, 138, 162; van der Waerden, states that the scorpion's horn is used as a synonym for the Balance in MUL.APIN, *History of the Zodiac*, 226.

352 Wallenfels, "Zodiacal Signs," 285; Greenfield, "The Names," 100.

353 D.J. de Solla Price, *Gears from the Greeks* (TAPS 64:7; Philadelphia: APS, 1974), 17–18; R. Hannah, *Time in Antiquity*, London: Routledge, 2008, 48–49. ref: to Hewlett Packard site containing publicly available images: http://www.hpl.hp.com/research/ptm/antikythera_mechanism/full_resolution_ptm.htm (image no. AK31a). Cited 31 October 2009, or the link via the team's website: http://www.antikythera-mechanism.gr/. (*See also* p.418 and Figure 5.4.1, p. 420).

354 Price, *Gears from the Greeks*, 1–70; T. Freeth et al. "Calendars with Olympiad Display and eclipse prediction on the Antikythera Mechanism," *Nature* 454 (31 July 2008): 614–617; T. Freeth et al., "Decoding the ancient Greek astronomical calculator known as the Antikythera Mechanism," *Nature* 444 (Nov 2006): 587–591; M.T. Wright, "The Antikythera Mechanism reconsidered," *ISR* 32:1 (2007), 27–43.

355 Aratus (fl. third century B.C.E.) uses *Chēlai*, see Kidd, commentary on Aratus, *Phaenomena*, 211–213, the first appearance of the Balance may have been in Hipparchus's commentary on Aratus (3.3.4), see Kidd, 211; cf. *Geminos's Introduction* (trans. Evans and Berggren), 117, n. 12: they date the Commentary to c.160 B.C.E. and state that the Claws are used throughout, a Balance, once (iii 1.5). They also state that Eratosthenēs (*Catasterisms*, c.230 B.C.E.) always refers to The Claws.

356 Goold states that *Zugós and Libra* are not found before first century B.C.E. ("first in Geminos"), Manilius, *Astronomica* (LCL, Goold), Introduction, xxv.

depicted as a human figure holding a pair of scales; at Hammath Tiberias, the earliest extant pictorial Hebrew zodiac mosaic, the figure is naked and holds a sceptre as well as scales.[357]

Sagittarius, The Archer, or The Bow קשתא in 4Q318 is ambiguous, its meaning depending upon the consonants.[358] The name in Sumerian, likewise, may mean the Archer or Bow: PA.BIL.SAG.[359] It is the Archer in Greek (Τοχότης). The sign is visually depicted as a centaur-archer in Akkadian and Mesopotamian sources, such as boundary stones and seal impressions.[360] The image of the Sagittarian centaur-archer is also known in the Greco-Roman literary tradition and is described as such by Manilius and Ptolemy.[361] Aratus (fl. early third century B.C.E.) writes of the Archer drawing his bow, without being part animal; the Centaur being a separate constellation.[362] The representation of Sagittarius in the Hebrew synagogue mosaic traditions are mixed: *Qashat* is represented by a centaur-archer in the Sepphoris zodiac;[363] at Huseifa and Beth Alpha, it is symbolised by a human archer; at Huseifa, he is naked.[364] The Qumran Sagittarius may be a literal translation of the name from either the Babylonian or Greek. The visual and literary representations of the sign as a centaur-archer may have an accompanying oral tradition. Although the Babylonian and Greco-Roman imagery contravenes Lev 19:19 prohibiting the mixing of species, there is nothing in the sign-name itself to denote a centaur. The Mandaic translation of Sagittarius, *hitia*, means "arrows,"[365] which may reflect the tradition of the bow, not the centaur.

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357 Hachili, *Ancient Mosaic Pavements*, 42, pl. III.9a; fig. III–8.

358 Greenfield, "The Names," 100.

359 Greenfield, "The Names," 100; Hunger and Pingree, MUL.APIN, 138, 160; Wallenfels, "Zodiacal Signs" 286, no. 9, fig. 12, seal impression dated from 230 B.C.E., Babylonian star catalogue (BM 78161) from c. 5th–7th centuries; Rogers, " Origins. I," 26–27; van der Waerden, "History of the Zodiac," 226.

360 van der Waerden, *History of the Zodiac*, 226–227, fig. 4; Wallenfels, "Zodiacal Signs," 286 no. 9, fig. 12, 287–288, figs. 16, 17.

361 Manilus, *Astronomica* 1.270 (Goold, LCL); Ptolemy, *Tetrabiblos* 1.27 (Robbins, LCL), 50–51 n. 3. The centaur is known from boundary stones, van der Waerden, "History of the Zodiac," 226–227, fig. 4.

362 Aratus, *Phenomena* 300–310 (Kidd, 94–95).

363 Wadeson, "Chariots," fig. 4b, p. 29; B. Kühnel, "The Synagogue Floor Mosaic in Sepphoris," in *From Dura to Sepphoris* (ed. L. Levine and Z. Weiss; JRA Supplementary Series 40; Portsmouth, RI: JRA, 2000), 31–43 (33, 36–39); Hachili, *Ancient Mosaic Pavements*, 42–43, fig. III–8; fig. III–3.

364 Hachili, *Ancient Mosaic Pavements*, 42–43, pl. III.9; fig. III–8.

365 Greenfield, "The Names," 100; J. Greenfield and J. Naveh, "A Mandaic lead roll with four incantations," *Eretz Israel* 18 (1985), 97–106 [Hebrew], cited in handout by C. Müller-

The Qumran sign name of Capricorn, גדיא, The Kid, a young goat, is in contrast to both the Babylonian and Hellenistic traditions wherein the sign-name is the Goat-fish" (Gk: ʼΑιγόκερως; Akk: suhurmašû).[366] The Aramaic dialects also know *Gadyā*, the Kid Goat, and Hebrew has the exact equivalent, *Gedī*.[367] The sign is visually represented by a goat-fish in the fourth century synagogue mosaic of Hammath Tiberias, and by a goat at Beit Alpha.[368] *4QZodiac Calendar* contains the first known attestation in an ancient primary source of this variant sign-name. The possibility may be considered that the young goat is a Judaised version of the sign-name because a pagan sea-goat, an amalgam of two separate species, would be regarded as abominable in biblical law.[369]

Aquarius, דולא, The Bucket, is also unattested in either the Babylonian and Hellenistic zodiacal traditions. The Qumran sign name is not an Aramaic translation of the Greek Ὑδροχόος, Water-pourer, nor the Akkadian GU.LA, "Great One,"[370] who may have originally represented the Sumerian god, Ea.[371] The Mesopotamian name may also contravene the biblical precept and first Commandment that there should be no other gods: Exod 20:3 and Deut 5:7. Similar translations to The Bucket for Aquarius are also found in Syriac and Mandaic;[372] Greenfield states that the reception history of דולא is Semitic, adopted into Middle Persian, and Hebrew, as attested in the Hebrew synagogue zodiac mosaics.[373] The visual representation of a Bucket, דלי, *Deli* in the Byzantine Hebrew synagogue mosaics varies from the traditional, classical representation of a naked, Greco-Roman figure pouring water backwards from

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Kessler, "Mandaic signs of the zodiac and related sources," at the 29th ARAM conference, "Astrology in the Ancient Near East," Oxford, 8–10 July 2010.

366 Greenfield, "The Names," 100–101; Wallenfels, "Zodiacal Signs" 285, fig. 9, dated to the first half of the second century B.C.E. and, 286, no. 10, fig. 13, dated to 281 B.C.E.; van der Waerden, "History of the Zodiac," 226; Manilius, *Astronomica* 2.167–180 (Goold, LCL); Ptolemy, *Tetrabiblos* (Robbins, LCL), 53, n. 1, 173, 205.

367 Greenfield, "The Names", 100–101.

368 Hachili, *Ancient Mosaic Pavements*, 43–44 (pl. III. 10a; fig. III–9).

369 Lev 19:19. The image goat-fish is found in the synagogue zodiac of Hammat Tiberias; however, it is not used at Beth Alpha. (Summary of images: L. Wadeson, "Chariots of Fire," ARAM 20 (2008): 1–41 (pl. 6, p. 31); Fine, *Art and Judaism in the Greco-Roman World*, 196–205.

370 Hunger and Pingree, *MUL.APIN*, 68 (Tablet I iv 36), 144.

371 Edith Porada, "On the Origins of Aquarius," in *Language, Literature and History* (ed. Francesca Rochberg-Halton; AOS 67; New Haven, CN: American Oriental Society 1989), 279–291; Rogers, "Origins I," 11, 17, 19, 21, 27.

372 Greenfield, "The Names," 101.

373 Greenfield, DJD 36, 268.

an urn, which he carries on his shoulder (Hammath Tiberias), where the name is spelled in mirror writing,[374] to a more literal rendering of the sign-name (Beit Alpha, Huseifa, and possibly Sepphoris).[375] The Bucket in 4Q318 removes the water pourer and focuses on a receptacle. In Greek imagery, the Water Pourer may have one urn;[376] in second millennium B.C.E. Mesopotamian wax cylinder seals, Ea carries two vessels flowing with water and has fish at his shoulders,[377] possibly representing the adjacent constellation of Pisces. In later iconography, he has two streams running over his shoulders that terminate in two vessels; the two streams emanate from a third vessel that he holds at his chest.[378] In removing the physical water element and the person who pours water, The Bucket also changes the astronomical basis of the Greek sign name, which reflects the sign's connection with constellation of Pisces.[379] The Qumran receptacle without its human water pourer did not travel west.

In this sub-section I have viewed the zodiac sign names of 4Q318 from a broad etymological perspective to draw together a picture of the cultural and

374 Dothan suggests that the mirror writing indicates that the craftsman did not know the Hebrew language and characters, particularly as the naked male figures are uncircumcised [only Libra is fully exposed and it may be argued that the illustration is not anatomical], although he also accepts that it may be deliberate as *Deli* begins with a variant *vav* "and Aquarius" at Beth Alpha, and in the Ein Gedi inscription, Dothan, *Hammath Tiberias*, 48, n. 280. See A. Mirsky, "Aquarius and Capricornus in the 'En Gedi Inscription," *Tarbiz* 40 (1971), 376–384 [Heb]. At Beth Alpha, Pisces also begins with a *vav*, so the panels read, "and Aquarius" "and Pisces." At Ein Gedi there is no word space between "and Aquarius" and "Pisces," so the inscription here reads as one word; however, there is no more space at the end of the line (line 2, panel 2). On the other hand, the craftsman would presumably have plotted out the inscription first and the spaces between the other zodiac signs are wide, therefore, the linkage of the two sign names into one may be deliberate. Furthermore, the artist at Hammath Tiberias inscribed the other zodiac sign names in Hebrew correctly. For a transcription of the Ein Gedi inscription and further comments, and see, L. Levine, "The Inscription at the 'En Gedi Synagogue," in *Ancient Synagogues Revealed*, 140–145 (at 140–142).

375 The Beth Alpha mosaic depicts a woman with a Roman hairstyle lowering a bucket into a well; at Huseifa an amphora with flowing water is represented, and at Sepphoris only stylised falling water survives, see Hachili, *Ancient Synagogue Mosaics*, 43–44, pl. III.10b; fig. III–9.

376 Manilius, *Astronomica* 1.272 (LCL, Goold). In Aratus, the number of urns is not given, *Phaenomena* (trans. Kidd), 390.

377 Porada, "On the Origins of Aquarius," figs. 1, 3, 12, 13, 14, 15, 16, 17; Rogers, "Origins I," (figs. 2, 5).

378 Wallenfels, "Zodiacal signs," 286–7, fig. 14.

379 Rogers, "Origins I," 27; Aratus, *Phaenomena* 385–390 (trans. Kidd, commentary: 323–324); Manilius, *Astronomica* 1.272, 1.438–442 (Goold, LCL).

chronological context of the zodiac at Qumran. 4Q318 contains two previously unknown variant zodiac sign names, Capricorn and Aquarius, and a mixture of well-attested Mesopotamian and Hellenistic names. The new name for Capricorn, The Kid, does not contravene biblical laws, whereas in both the Babylonian and Hellenistic zodiacs, Capricorn is represented by the goat-fish, a goat with a fishtail, which may be unacceptable to the community within Second Temple Judaism in which *4QZodiac Calendar* was composed (not necessarily at Qumran). The Kid is distantly related to the image of the goat-fish that it replaces while still preserving a trace of the sign's Babylonian and Hellenistic origins. According to Bobrova and Militarev the Sumerian and Akkadian goat-fish was a carp-fish that evolved through etymological processes into a goat-fish, hence the image of a goat with a fishtail on boundary stones.[380]

The Hellenistic concept of the next sign, the Water Pourer, does not infringe biblical law, but its Mesopotamian sign name of GU.LA, another deity, possibly does. It may have been too culturally specific to have been translated into Aramaic and transplanted in the Dead Sea Scrolls. The Bucket may be related to the imagery and iconography of the water pourer in both the Greek and Mesopotamian traditions, but it removes both the water and the pourer from the name in Greek, and the deity from the Akkadian sign name. Whatever the reason for the variant sign names at Qumran, their existence shows that the composer or composers of the 4Q318 zodiac were not averse to revising zodiacal names for cultural or theological reasons. This tradition may have continued, as shown by the change of the name of Aries from The Ram in *4QZodiac Calendar* to the adoption of a Lamb, attested in the early Byzantine Hebrew zodiac mosaics.[381] Here again, the imagery, not the etymology, is loosely related but distinctively different.

The origin of the Qumran zodiac could date to the period when the Ear of Grain was visually represented by a female holding a spike of corn, attested in the early second century B.C.E. If the Qumran zodiac, as an ensemble, was of Western Hellenistic origin, it could not be earlier than the late second century B.C.E. when The Balance, the Babylonian zodiac name, first appeared in the Geminos Parapegma. In that case, though, it could date from the early first century C.E., when, according to Goold, The Balance was more commonly used in Greco-Roman writing than The Claws. The composition of 4Q318, then, would correlate approximately with the date of the scroll itself. On the other hand, if a Seleucid Mesopotamian background is considered, the date of the original Qumran zodiac need not be determined by the period when the

380 Bobrova and Militarev, "From Mesopotamia to Greece," 322.

381 For an etymological discussion on "lamb" and "ram", see Greenfield, "The Names," 98.

Mesopotamian Balance replaced the Hellenistic Claws because the Babylonian Libra was never the Claws of the Scorpion.

The Egyptian zodiacs, including two from the temple of Dendera that are dated to 30 B.C.E., and the reign of Tiberius in the early first century C.E.,[382] also depict the Balance, not the Claws.[383] According to Neugebauer and Parker, the iconography is "undoubtedly Babylonian in origin" as attested by the representations of the goat-fish (Capricorn), a double, or single-headed archer on a usually winged, scorpion-tailed horse, (Sagittarius), and the most common representation of woman holding an ear of corn (Virgo).[384] The Scales may also have been compatible with existing sacred and vernacular Egyptian iconography.[385] In addition to being symbolised by the scales or a balance held by a figure, " 'Libra,' the only named sign," is also represented by the word for "horizon," a sundisk, a sundisk with scales, or a Horus-child baboon, related to the word for "horizon" in Egyptian astronomical texts and in monumental imagery.[386] Aquarius has many variations as a water pourer in the Egyptian zodiacs: the figure may be standing or seated, or pouring water from one, or two, vessels. In some instances, the sign is depicted by a papyrus plant, and no vessels or water are shown at all. Aquarius may also be represented by the Nile god, Hapy, wearing a papyrus crown.[387] Although Egypt may be considered as a possible place of transmission for the zodiac in the Dead Sea Scrolls due to its geographical proximity to Qumran, these graphic representations might make a direct Egyptian connection with the names of the zodiac signs in 4Q318 unlikely.

In the foregoing, by taking a comparative, diachronic approach it was found that the Qumran zodiac contains both late Hellenistic and late Babylonian

382 O. Neugebauer and R.A. Parker, *Egyptian Astronomical Texts III* (Providence, RI: Brown, 1969) [abbrev. *EAT*], Esna A, 200 B.C.E., now destroyed, 168, Dendera B, before 30 B.C.E., pl. 35; Shanhûr, 30 B.C.–27 C.E., pl. 40; Dendera E, 20 C.E., pl. 42; Tester, *A History of Western Astrology*, 20; Campion, *A History of Western Astrology*, 1:182–183.

383 Neugebauer and Parker, *EAT* III, 210, 218, fig. 33-A.

384 Neugebauer and Parker, *EAT* III, 168, 203, 209–211.

385 See images from the weighing of the heart ceremony in Book of the Dead of Hunefer (19th Dynasty, c.1280 B.C.E., Chapter 25: painted papyrus, British Museum catalogue no. EA9901, Sheet 3), in I. Shaw and P. Nicolson, *British Museum Dictionary of Ancient Egypt* (London: British Museum Press, 1995), 30; M. Gutgesell, "Economy and Trade," in *Egypt: The World of the Pharaohs* (ed. R. Schulz and M. Seidel; Cologne: Könemann, 1998), 373, pl. 74: Weighing of gold and silver, tomb, c.1380 B.C.E., 374, pl. 75, The Treasury of Pharaoh, tomb c.1250 B.C.E.

386 Neugebauer and Parker, *EAT* III, 132, 210, 218.

387 Neugebauer and Parker, *EAT* III, 211–212; van der Waerden, "History of the Zodiac," 229, figs. 5, 7, 9.

features, reflecting a mixture of cultural influences. These could be accounted for by a process of composition in Hellenistic Seleucid Mesopotamia from the early second century; a late Western Hellenistic influence in the early first century (the very latest date for the scroll) or, less satisfactorily, by Greenfield's hypothesis of transmission by a Greek scholar in the Persian court. By the early first century C.E. in Judea, cultural influences were undoubtedly intertwined. If *4QZodiac Calendar* were composed or translated into Aramaic at this time rather than copied from an earlier tradition, the question of a Western Hellenistic influence could be considered.

The fourth possible influence in the mix may be Judean itself. The Aramaic zodiac at Qumran is the first primary source of a new zodiac containing two completely hitherto unattested zodiac sign names: those for Capricorn and Aquarius. It is also unique because the Hebrew zodiac, which overlaps it in all other respects, has a different name for Aries. I suggest that due to the fact that 4Q318 contains the earliest attested variant zodiac names, the Qumran zodiac may be considered significant as a possible Judean construct.

The reasons are as follows: a) the variant Qumran zodiac sign names do not contravene biblical law, in contrast to the equivalent sign names in Mesopotamian and Greco-Roman traditions; b) in their specific context—the Dead Sea Scrolls, an archive containing biblical manuscripts and commentaries on biblical law—the variant sign names would be more acceptable than the non-variant versions. The process of etymological evolution and simple translation into Aramaic may also be considered as a reason for the variants; however, the fact remains to be explained that Bucket and Kid, not Water-Pourer and Goat-fish, were found in the Byzantine Hebrew synagogue zodiac mosaics and those sign-names are still extant in the Hebrew zodiac. It would be interesting to trace the socio-cultural background of the transmission process of these two signs, not only in Hebrew, but also to the eastern Aramaic cultures where they have survived, too.

It would also be intriguing to research why the Hellenistic, Qumran and Hebrew Virgo, the Virgin, was not transmitted to the eastern Aramaic zodiacs. In the next sub-section, I will discuss the Aramaic numerical digits used for the days of the month in 4Q318 before moving to the Babylonian-Aramaic month names. When examined together, the calendrical textual components of *4QZodiac Calendar*, its zodiac, its numerals, and month names, may clarify the religious, historical and cultural background of the scroll.

1.5.1 *The Aramaic Numerals*

The days of the months in *4QZodiac Calendar* are represented by Aramaic numeral signs that are also used in some other documentary and non-documentary scrolls to represent numbers, or days of the week, months, or

measurements.[388] Variations of these numerical symbols are found in the Qumran scrolls: *4QOtot* (4Q319), *4QCalendrical Document/ Mishmarot A* (4Q320), *4QCalendrical Document C* (4Q326), *4QBiblical Chronology/ 4QpapBibChron ar* (4Q559), (*6QCalendrical Document* (6Q17).[389]

The Aramaic numerals are descended from Phoenician and Babylonian sources, forms of which are attested from the eighth century B.C.E. to the third century C.E.[390] They were used by the Egyptian-Hebrew colony in Elephantine, appearing in fifth century B.C.E. Aramaic papyri legal documents (for the days of the month and cardinal numbers).[391] They are also attested in fourth century B.C.E. Samarian papyri legal documents from Wadi Daliyeh (for the days of the month and cardinal numbers).[392]

In 4Q318, the single digits are represented by short downward, slanting strokes with longer, straight strokes for the final third, fourth and fifth digits in the numbers one to five. The numeral six is composed of two units of three; seven, by a unit of three and four; eight, by two units of four; and nine by three units of three. The number 10 is represented by a curved deep hook, and 20, by two hooks, one joined on top of the other like the Arabic number **3** leaning downwards at a slight angle.

Yardeni comments that the number eight in *4QZodiac Calendar* is "very unusual" (4Q318 col. iv line 9) consisting of two units of four strokes: in Aramaic documents from the Persian period, the number symbol for eight is

388 Yardeni, DJD 36, 261; E. Tov, *Scribal Practices and Approaches to Texts Found in the Judean Desert* (STDJ 54; Leiden: Brill, 2004), 212–213, 212 n. 265 (bibliography), 213 (Table 17); Talmon and Ben-Dov, DJD 21, 42, 137 nn. 12–15 (bibliography).

389 S. Talmon, "Calendars and Mishmarot," in *EDSS*, 1:109; 4Q319: Ben-Dov, DJD 21, transcriptions, 214–244 (Pls. 10–13); Talmon and Ben-Dov, DJD 21, 4Q320 transcriptions, 42–62 (pls. 1–2); Talmon and Ben-Dov, DJD 21, 4Q326 transcriptions, 134–135 (pl. 7); 4Q559: E. Puech, DJD 37, transcriptions, 271–289 with reconstructions (pl. 15), cf. García Martínez and Tigchelaar, *DSSSE* 1114–1115 and E. Cook, 4Q559. DSSR 2.136–139 have converted the numerical symbols to Arabic numbers; 6Q17: M. Baillet, DJD 3, 132–133 (pl. 27).

390 S. Gandz, "Hebrew Numerals," *PAAJR* 4 (1933): 53–73 (esp. 68–69) 72: Table 1 and Table 3, Fig. 9.

391 Gandz, "Hebrew Numerals," 62–64; B. Porten, et al. *The Elephantine Papyri in English* (DMOA 22; Leiden: Brill, 1996), for example, pl. 2 (TAD B3.3 [B36]) = Brookyn 47.218.89, "Document of Wifehood." the date and quantity of goods and monetary agreements, lines: 1 (18 Av), 4, 7, 8, translation, 208–211.

392 D.M. Gropp, *Wadi Daliyeh II: The Samaria Papyri from Wadi Daliyeh* (DJD 28; Oxford: Clarendon, 2001), 3. 35, for example, WDSP 1 papDeed of Slave Sale A (Pl. 1), extant lines: 1 3, 8, 10 (par-extant), transliteration, translation and commentary, 34–44.

usually represented by two units of three and one unit of two strokes.[393] The symbols for 20 and 10 precede the single-digit numerals; this is also the case with *4QCalendrical Document C* (4Q326), *4QBiblical Chronology* (4Q559) and *6QCalendrical Document* (6Q17), whereas in *4QCalendrical Document/ Mishmarot A* (4Q320) the symbol for 20 precedes the numeral for 10 (for the 30th and 31st) but it comes at the end of a sequence of single digit numerals (for 20s).[394]

The calendrical scrolls, 4Q319, 4Q320, 4Q326, are related to the 364-day calendars of the priestly courses, the *mišmarot*, which are regarded as "sectarian," origin.[395] 4Q320 has a different orthography to the "Qumran scribal practice,"[396] and the arrangement of the number symbols is also different; it is unclear what form of the 364-day festival calendar is described in 4Q326.[397] Although there are Hellenistic influences in the names of the signs of the zodiac, the symbols for the days of the month are unconnected to the Greek alphabetic number system, which dates from the eighth century B.C.E., and which possibly originated in Miletus, in Asia Minor.[398]

In summary, the Aramaic numerical symbols in 4Q318 can be traced to their Phoenician and Mesopotamian origins, and are known from legal documents from the Hebrew-Egyptian colony at Elephantine, and the Samaria papyri documents from Wadi Daliyeh. Since the Aramaic numerical symbols are extant in other calendrical documents from Qumran, it may be argued that this feature

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393 Yardeni, DJD 36, 261, col. iv is the second largest fragment (now completely dark and unreadable), the line concerned is the last line which is line 9, not line 7 as stated by Yardeni.

394 Talmon and Ben-Dov, DJD 21, 137.

395 4Q319: Ben-Dov, DJD 21, 195–201. Ben-Dov, *Head of All Years*, 147–148; Vanderkam, *Calendars*, 80–84; Glessmer, "Calendars," 262–268; U. Glessmer, "The Otot-Texts (4Q319)" in *Qumranstudien*, 125–164; U. Glessmer, "Investigation of the Otot-text (4Q319) and Questions about Methodology," in *Methods of Investigation of the Dead Sea Scrolls and the Khirbet Qumran Site* (ed. M.O. Wise et al.; ANYAS 722; New York: New York Academy of Sciences, 1994), 429–440; Milik, *The Books of Enoch*, 61–69; S. Metso, *The Serekh Texts* (CQS 9; LSTS 62. London: T &T Clark, 2007), 5, 14; F.M. Cross, "The Paleographical Dates of the Manuscripts," in *The Dead Sea Scrolls: Hebrew, Aramaic, and Greek Texts with English Translations*, 1:5. Milik dated the scroll to the second half of the second century B.C.E., *BE*, 61–64; P. Alexander and G. Vermes, *Qumran Cave 4. 19: 4QSerekh Ha-Yaḥad* (DJD 26; Oxford: Clarendon, 1998), 10–11; Albani, *Astronomie und Schöpfungsglaube*, 282–296.

396 4Q320: Talmon, DJD 21, 37–63 (esp., 39, 41); Tov, *Scribal Practices*, 250, 262, n. 320, 286, 261–270. E. Tov *Textual Criticism of the Hebrew Bible* (2nd revd. ed.; Minneapolis, MN: Fortress Press), 107–114.

397 4Q326: Talmon, DJD 21, 134.

398 Neugebauer, *Exact Sciences*, 11.

in *4QZodiac Calendar* was part of a scribal convention in the contemporary, surrounding culture in Judea for documentary and documentary-style texts written in Hebrew and Aramaic. The Aramaic numerals do not have any Hellenistic features and are extant in a documentary-style text, 4Q559, and four calendrical scrolls 4Q319, 4Q320, 4Q326, and 6Q17, the first three of which are related to the 364-day calendar of the priestly courses. 4Q318 is, therefore, not isolated in respect of its numerals among the scrolls including possible sectarian scrolls, those of the priestly courses. In the next section, the month names in 4Q318 are discussed.

1.6 Babylonian-Aramaic Month Names

This section will address the issues raised by the fact that *4QZodiac Calendar* uses the Aramaic translations of Babylonian month names—Shevat (col. viii 4) and Adar (col. viii 1)—a rare textual feature at Qumran. 4Q318 is not the only scroll to use the Aramaic translations of the Babylonian months, although it is the only Aramaic text to do so. In addition to discussing a second, Hebrew, scroll from Qumran with a Babylonian-Aramaic month name and its significance, I will also outline the prevalence of texts that use the Babylonian-Aramaic month names in Elephantine, Samaria, Judea, and the Bible in order to demonstrate the wealth of relevant primary source material where the Babylonian month names are evident.

As noted in the discussion on the early rabbinical calendar, according to tradition recorded in the Jerusalem Talmud, the Aramaic month names were adopted from the period of Exile (and have remained unchanged in the rabbinical calendar to the present day). The extant Babylonian-Aramaic month names appear in the post-exilic Books of Ezra, Nehemiah, Esther and Zechariah,[399] and in the fifth century B.C.E. Passover Papyrus and other legal documents from Elephantine.[400]

399 Ezra 6:15, Neh 1:1, 2:1, Esth 2:16, 3:7, 7, 13, 8:9, 12, 9:1, 15, 17, 19, 20, Zech 1:7, 7:1; Stern suggests that the post-exilic biblical and Babylonian calendars are identical, in "The Babylonian Calendar at Elephantine," *ZPE 130* (2000), 159 n. 4; Stern, *Calendar and Community*, 29, 29 n. 131; D. Talshir and Z. Talshir argue that Babylonian month names could only have been in use at the end of the Second Temple period, and that therefore the literary use points to late compositions, or editing: "Double Month Naming in Late Biblical Books: A New Clue for Dating Esther?" in *VT* 54:4 (2004), 549–554.

400 Herr, "The Calendar," 836–837; B. Porten, *Archives from Elephantine* (Berkeley: University of California Press, 1968), 128–130, 311–314, pl. 9; B. Porten and A. Yardeni, eds., *Textbook of Aramaic Documents from Ancient Egypt*, vol. 1 (Jerusalem: Hebrew University, 1986),

The texts which antedate Qumran and employ Babylonian-Aramaic month names are mainly documentary, from the Persian period. The majority of early documents in this category comprise a substantial number of mid-fourth century B.C.E., Samaria papyri from Wadi Daliyeh (abbrev. WDSP). These consist mainly of slave sale documents and other legal deeds, dated with the Aramaic translation of Babylonian month names and use the formula of: day, month and regnal year of the Persian king. Most were written during the reign of Artaxerxes III Ochus (358–337 B.C.E.).[401] One document dates to the reign of Artaxerxes II Memnon (375–365 B.C.E.);[402] WDSP 1, the date of which is fully preserved, was composed in the second year of Darius III (335 B.C.E.).[403] Gropp comments that the dating formula found in the Samaria papyri "is found frequently in post-exilic books of the Bible . . ."[404]

The scrolls from Judea that antedate 4Q318 include *4QDeed A ar or Heb* (4Q345), possibly from Naḥal Ḥever[405] (373–171 B.C.E., carbon-dated, but glue-contaminated).[406] Thus, as noted by Wacholder, Herr and many others,[407] the

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Passover Papyrus: A4.1; B. Porten, "The Calendar of Aramaic Texts from Achaemenid and Ptolemaic Egypt," in *Irano-Judaica II* (ed. S. Shaked and A. Netzer; Jerusalem: Ben-Zvi Institute, 1990), 13–32; B. Porten et al. *The Elephantine Papryi in English*, 81–82, Passover Papyrus: B13: 125–126; Stern, "The Babylonian Calendar at Elephantine," 159–171; Stern, *Calendar and Community*, 28–30; VanderKam, *Calendars* (1998), 114.

401 D.M. Gropp, *Wadi Daliyeh II: The Samaria Papyri from Wadi Daliyeh* (DJD 28; Oxford: Clarendon, 2001), 3.

402 Gropp, DJD 28, 3.

403 Gropp, DJD 28, 3, 30–36. Papyri with extant dating formulae: WDSP 1.1 (20th Adar) (Plate 1); 2.12 ([Tebe]t) (Plate 2); 3.11–12 (3rd Shevat) (Plate 3); 4.1 (Plate 4); 5.1 (Plate 5); 7.19 (5th Adar) (Plate 7); 8.12–13 (Plate 8); 9.15–16 (Plate 9); 10. recto 1.12 (Plate 10); 12.10–11 (Plate 13 only); 14.1 (Plate 16 only); 15.1 (Plate 16); 16.1 (Plate 17 only); 17.1–2, 8–9 (Plate 18 only); 18.11 (Plate 19); 19.1 (Plate 20 only); 20.1 (Plate 20 only); 22.10–11 (Plate 21 only). See: J. Dušek, *Les manuscripts araméens du Wadi Daliyeh et la Samarie vers 450–332 av.J-C* (Leiden: Brill, 2007).

404 Gropp, DJD 28, 35.

405 A. Yardeni, DJD 27, 292–295, fig. 29, pl. 56. Cf.: H. Eshel, "4Q348, 4Q343 and 4Q345: Three Economic Documents from Qumran Cave 4?" *JJS* 52 (2001): 132–135. Eshel argues that the documents came from Qumran: S. Reed, "Find Sites of the Dead Sea Scrolls," *DSD* 14.2 (2007): 212–213.

406 A.J. Timothy Jull et al., "Radiocarbon Dating of Scrolls and Linen Fragments from the Judaean Desert," *Radiocarbon* 37:1 (1995), 11–19 (esp. 12). 4Q345: באלול (in Ellul) Recto, upper version, line 1; lower version, line 10 (Yardeni, DJD 27), 292–293.

407 B.Z. Wacholder, "Calendar Wars Between the 364 and the 365 Day Year," *RevQ* 20. 78 (2001), 208–222 (208, 217); M.D. Herr, "The Calendar," in *The Jewish People in the First Century*, vol. 2 (ed. S. Safrai and M. Stern; Philadelphia: Fortress Press, 1987), 834–843.

theory that Antiochus IV imposed the Babylonian luni-solar calendar on the Temple authorities does not take into account the idea that the Babylonian calendar may have already been in use in Judean society.

In addition to 4Q318, the Babylonian-Aramaic calendar month names found in texts at Qumran are: 4Q332 (*4QHistorical Text D*) (c. 25 B.C.E.) frag. 2 line 2: שבט (Shevat),[408] and possibly in 4Q322a (*4QHistorical Text H?*) frag. 2 line 5:] למ[רח]שון [(of Ma[rhe]shvan),[409] part of the corpus of historical chronological texts.

The assignation of *4QHistorical Text H?* as a text containing an Aramaic month name is uncertain. Tigchelaar states that the possible reference to Ma[rche] shvan may be compared to the reference to Shevat in 4Q332 (*4QHistorical Text D*) frag. 2 line 2[410] and he accepts that the lacuna is "rather small for [רח]."[411] Although Tigchelaar's reconstruction of the month, Ma[rche]shvan, in *4QHistorical Text H?* has been accepted by Talmon and Ben-Dov,[412] it is not conclusive. The extant text in other fragments of this scroll include numbers that may, or may not, be calendrical: (4Q322a frag. 1 line 8]שבעים יו['seventy,'[413] 'or sevenday[s']שבעימי;[414] 4Q322a frag. 2 line 6: שני שמנים° 'eighty,'[415] or '° second

408 J. Fitzmyer, DJD 36, 281–286 (at 283–284). pl. 17; K. Atkinson, "Representation of History in 4Q331 (4QpapHistorical Text C), 4Q332 (4QHistorical Text D), 4Q333 (4QHistorical Text E), and 4Q465e (4QHistorical Text F): An Annalistic Calendar Documenting Portentous Events?" *DSD* 14.2 (2007), 125–151; Atkinson dates *4QHistorical Text D* to "no earlier than 65 B.C.E" on the grounds of the possible historical references, op. cit., 134–138 (esp. 137); B.Z. Wacholder and M.G. Abegg, *A Preliminary Edition of the Unpublished Dead Sea Scrolls*, fasc. 1 (Washington D.C.: BAS, 1991), 80–81, 84–85; G.J. Brooke, "Types of Historiography in the Dead Sea Scrolls," in *Ancient and Modern Scriptural Historiography* (ed. G.J. Brooke and T. Römer; Leuven: Peeters, 2007), 221; Fitzmyer, DJD 36, 275; S. Talmon and J. Ben-Dov, "*Mišmarot* Lists (4Q322–324c) and 'Historical Texts' (4Q322a; 4Q331–4Q333) in Qumran Documents," in *Birkat Shalom*, vol. 2 (ed. C. Cohen et al.; Winona Lake, IN: Eisenbrauns, 2008), 927–942; J.J. Collins, "Historiography in the Dead Sea Scrolls," 19.2 (2012): 159–176.

409 E.J.C. Tigchelaar, "4Q322a Historical Text H?" in DJD 28 (ed. D.M. Gropp; Oxford: Clarendon, 2001), upper recto, line 1, lower recto, line 10 [reconstructed]), 125–128, pl. 40.

410 Tigchelaar, "4Q322a Historical Text H?" in DJD 28, 125.

411 Tigchelaar, "4Q322a Historical Text H?" in DJD 28, 127.

412 Talmon and Ben-Dov, "*Mišmarot* Lists," in Cohen et al., eds., *Birkat Shalom*, 2:933. They conclude that the use of a Babylonian month name is one of the factors which "distinguish" 4Q322a "from other texts with standard *mišmarot* terminology."

413 Transcription and translation, Tigchelaar, DJD 28, 126.

414 See DJD 28, pl. 15: there is no space between the *mem* and the second *yod*, contra Tigchelaar's interpretation. The spaces between other words in the text are very clear, see the line above. I would suggest that that second *yod* is part of the word ימ]י attached to שבע.

415 Transcription and translation, Tigchelaar, DJD 28, 127.

eight' שני שמנה◦;[416] and, 4Q322a frag. 3 line 6 ה]תשעֿ 'nine[').[417] Since the possible Babylonian month name in *4QHistorical Text H?* is uncertain, this subsection will focus on the implications of *4QHistorical Text D. 4QHistorical Text D* (4Q332) fragment 2 has a double date: it contains the remains of a date within a numerical 364-day calendar, possibly the 20th? of the month[418] and the only other secure Babylonian-Aramaic month name outside of 4Q318: 9th of Shevat (4Q332 frag. 2, lines 2–3). The other dates in the text appear to belong to the Jubilees-Qumran calendar alone but used as historical dates, not as a calendar of the priestly courses.[419] The full translation of 4Q332 frag. 2 by Fitzmyer is included below, to place the double-date in lines 2–3 in its textual context as a historical chronicle.

4Q332 frag 2. lines 2–3

1 ל]תת לו יקר בערב[ים
2 בת] שֹעה לשבט זה[—]
3]ה שהוא[ע]שֹרֹים בחודשֹ[—]

1. [to] give him honour among the Arab[s]
2. [on the n]inth of Shebat, this (is) [ ]
3. [ ] which is the [tw]entieth [?] in the month [of][420]
4. [ ]with secret counsel Salome came [

5. [ ] to confront the[ ]

416 See DJD 28, pl. 40: Tigchelaar has not translated שני ◦ and his reconstruction of שמנֿ is uncertain due to the tear after the possible *nun*. If שמונה were spelt defectively (cf. 4Q317 frag 1+1a, col. ii line 7; 4Q317 frag 7, col. ii line 18; 4Q317 frag 21, line 4; 4Q320 frag 6, line 4), as suggested, a possible translation, to include שני ◦ could be "] ◦ second eight." Although, the possible *nun* may be a *resh*. (cf. 4Q322 (*4QMishmarot A*) line 3, in DJD 21, pl. 5 and p. 96).

417 Transcription and translation, Tigchelaar, DJD 28, 128. However, see pl. 40: this may be an over-reconstruction; the only identifiable letter from the photograph is *shin*.

418 Fitzmyer, DJD 36, 282.

419 4QHistorical Text D (4Q332) fragments 1 and 3 contain extant references to the names of the priestly service and corresponding dates in the calendar of the priestly courses. With regards to 4Q332 frags 1 and 3 Talmon and Ben-Dov state that the calendar of the priestly courses is being used to pinpoint historical events, rather than fulfilling a specific calendrical purpose: (Talmon and Ben Dov, DJD 21, 12–13).

420 Transcription and translation, "4Q332," Fitzmyer, DJD 36, 283. Cf. Wise, *Thunder in Gemini*, 188, 191: frag 2, (2):] בעה לשבט זה[ביום אר (3). ה שהוא אשרים בחודש[Trans: (2) [on the fou]rth [day] of this course's service . . . (3) which is the twentieth of the [ ] month . . .

6. [ ] Hyrancus rebelled [against Aristobulus]
7. [ ]to confront[

Fitzmyer dated the text to the last quarter of the first century B.C.E.,[421] and agreed with Milik's reading of the text as "neuf de Šebat" adding:

> This makes sense, but it introduces a name of a month (שבט) into this text, when related Mishmarot and calendrical texts use rather the numerical names for months. This may, however, be another reason for treating this text as different from them.[422]

In 4Q332 frag 2 the Babylonian-Aramaic calendar month name, Shevat[423] is synchronised with a numerical calendrical system, by use of the preposition זה (4Q332 frag 2 line 2).[424] As the occurrence of the single zodiac sign name, Taurus, in 4Q186 is significant for suggesting that 4Q318 was not the only scroll that was interested in the zodiac, so the incidence of at least one other scroll containing a Babylonian-Aramaic month name provides evidence to show that 4Q318 was not alone among the scrolls in its association with the Mesopotamian calendars. As noted in the Introduction, for Jaubert the presence of this fragment was evidence that two liturgical calendars co-existed in Second Temple Judaism and Glessmer states that the fragment confirms that two different calendars co-existed "beyond doubt."[425]

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421 Fitzmyer, "4Q332" in DJD 36, 281, dated c. 25 B.C.E. according to F.M. Cross, "The Development of the Jewish Scripts," in *The Bible and the Ancient Near East: Essays in Honour of William Foxwell Albright* (ed. G.E. Wright; Garden City, NY: Doubleday, 1961), 138, line 4.

422 Fitzmyer, DJD 36, 284 (Comments to line 2). His citation is: J.T. Milik: "Le travail d'édition des manuscripts du Désert de Juda," *Volume du Congrès, Strasbourg* 1956 (ed. G.W. Anderson; VTSup 4; Leiden: Brill, 1957), 25–26.

423 Fitzmyer, DJD 36, 283.

424 Fitzmyer, DJD 36, 284. The demonstrative pronoun is used again in 4Q322 frag 3 line 3 to date an event. (Fitzmyer, DJD 36, 285–286; Talmon and Ben-Dov "*Mišmarot* Lists," 932, 937–939, 941–942; cf. Brooke, "Types of Historiography," 221; Talmon and Ben-Dov, DJD 21, 12–13, 94–97, 99, 106. Double-dating is extant in the calendars of the priestly courses: possibly 4Q322 (*4QMishmarot A*), 4Q323 (*4QMishmarot B*), 4Q324 (*4QMishmarot C*) and 4Q324a (*4QMishmarot D*): DJD 21, 93–97, 99–101, 103–106, 107–111). In addition, the formula שהוא is used to convert one calendar into its parallel in 4Q332 frag 2 line 3. (Fitzmyer, DJD 36, 283–284).A similar formula with הוא appears in Esth 2:16 (also in Esth 3:7; 3:13; 8:9; 8:13; 9:1), a comparative dating system which will be discussed shortly.

425 Jaubert, *Last Supper*, 51–52, Glessmer, "Calendars," 228.

I agree that the double dating of a day with a Babylonian-Aramaic month name and an ordinal makes 4Q332 (*4QHistorical Text D*), fragment 2, a key calendar text in the Dead Sea Scrolls. The double-dating formula suggests that a calendar with Babylonian-Aramaic month names was not rejected in the so-called 'sectarian' texts,[426] if indeed the historical texts are 'sectarian.'[427]

No conclusions can be drawn about the numerical date itself because the ordinal 20th שׁ֫רֹ֫ים [ע] (4Q332 frag 2 line 3) is uncertain,[428] but the month, שבט (4Q332 frag 2 line 2) is very clear. If we applied the apparent numeric calendar of 4Q332 (*Historical Text D*) to the six-year cycle of the Qumran calendar of the priestly courses, the numeric calendar in 4Q332 apparently begins on the first lunar crescent. The reasons are as follows: the 9th of a possible Babylonian luni-solar month, Shevat (Month XI),[429] if cognate with the 11th numerical month of the cycles of the priestly courses,[430] coincides with the 20th of the 11th month (20/ XI) in Years 2 and 5 of the priestly service.[431] This means counting nine days from the unidentified lunar phenomenon 'X' in the numeric cycle, which falls on the 12th day of the 11th numerical month (12/ XI) in those years.[432] Counting inclusively, nine days from 12/ XI, would be the 20/XI. Hence,

426 Atkinson accepts the Historical Texts as 'sectarian', in "Representation of History," 131. n. 18; so, J.J. Collins, "Historiography," 159–176.

427 In his discussion on the Historical Texts, Brooke refers to their status as "whether sectarian or non-sectarian," in "Types of Historiography," 228.

428 Fitzmyer, DJD 36, 283.

429 The first visible lunar crescent signifies the beginning of the month in the Babylonian calendar: Sachs and Hunger, *Diaries from 652 B.C. to 262 B.C.* (vol. 1 of *Astronomical Diaries and Related Texts from Babylonia* completed and edited by H. Hunger), 13, 20.

430 Month I is the spring month (Nisan) in 1QS X 6, Talmon, DJD 21, 5 (and 4Q318: Greenfield and Sokoloff, DJD 36, 265).

431 Talmon et al., DJD 21, 13–14, Table 1: The Six-year Mišmarot Service Cycle: 17–28, paying particular attention to4Q320, 4Q321a and 4Q321.

432 There is disagreement as to which lunar phases are represented by "X" (in 4Q320) and *dwq* (4Q321a and 4Q321). See, VanderKam, *Calendars in the Dead Sea Scrolls*, 79; Abegg, "The Calendar at Qumran," 148–149; Abegg, "Does Anyone Really Know What Time It Is?" 396–406; S. Talmon et al., DJD 21, 14; J. Ben-Dov and W. Horowitz, "The Babylonian Lunar Three in Calendrical Scrolls from Qumran," *ZA* 95 (2005): 104–120; M.O. Wise, "Second Thoughts on דוק and the Qumran Synchronistic Calendars," in *Pursuing the Text* (ed. by J.C. Reeves and J. Kampen; JSOTSupplement 184; Sheffield: Sheffield Academic Press, 1994), 98–120; V. Gillet-Didier, "Calendrier lunaire, calendrier solaire et gardes sacerdotales: recherches sur 4Q321," *RevQ* 20 (2001/2): 171–205; Ben-Dov, *Head of All Years*, 197–244; S. Saulnier, *Calendrical Variations in Second Temple Judaism: New Perspectives on the 'Date of the Last Supper' Debate* (SJSJ 159; Leiden: Brill, 2012), 214–226; H.R. Jacobus, "The Babylonian Lunar Three and the Qumran Calendars of the Priestly Courses: A Response," *RevQ* 101.26 (2013): 21–51.

if the date, 9 Shevat, were calculated from the first visibility of the moon in a schematic calendar—an inference that the Babylonian-month name is related to the Babylonian calendar, which begins at the first lunar crescent—then 'X' on 12/ XI in this text represents the ideal first crescent and coincides with 1 Shevat, and 9 Shevat would align with 20/ XI.

Since the precise referent date in the numerical calendar is insecure in 4Q332 frag 2 lines 2–3, it is unclear whether the numeric calendrical datum in *4QHistorical Text D* may be factored into the six-year cycle of the service of the priestly course represented in 4Q320–321a and 4Q321–321a, or another kind of numerical calendar.

A different numerical calendar system is represented in 4Q322 (*4QMishmarot A*) [formerly catalogued as Mishmarot C^{b} 1{4Q323}][433] (the similarity of the sigla numbers, fragment numbers and line numbers can be confusing). This may be a reason for treating the 20th? as a numerical date precisely synchronised with the calendars of the priestly courses represented in 4Q320–321a with caution.

Aside from the problem of the exact harmonisation between two calendar systems, a further issue of interest is the structure of the calendrical notation in 4Q332 frag 2 lines 2–3. The compound calendrical formula in *4QHistorical Text D* is the reverse of that in the late biblical book of Esther (and Zech 1:7, 7:1, and 1–2 Maccabees), for example, in Esth 2:16:

בחדש העשירי הוא־חדש טבת

> in the 10th month which is the month of Tebet[434]

Talshir and Talshir, and Davies argue with reference to Esther that this formulaic order means that the Babylonian date, which here comes after the numerical date has replaced the out-of-date numeric month.[435] By the same argument, in the harmonised Hebrew Qumran calendar, *4QHistorical Text D*, the numerical calendar, which comes second in the formula, is replacing the Babylonian calendar. In that case, the Babylonian name which takes priority

433 Cf. 4Q322 (*4QMishmarot A*) lists priestly courses that appear to be synchronised with a calendar that is not accounted for in the sexennial cycle, DJD 21, 93–97, esp. 94–95; Talmon and Ben-Dov, "*Mišmarot* Lists," 931–932.

434 Jewish Publication Society, *Tanakh* [JPS], 1788.

435 Talshir and Talshir, "Dating Esther," 552–554; Davies, "Calendrical Change," 83. (For Davies, the numeric month is a 364-day calendar; Talshir and Talshir do not discuss the possible structure of the numeric calendar).

in the compound formula is the more familiar to the intended audience, and is being used to establish the numeric calendar using Hasmonean history, which may have been recorded with the Babylonian month names. That interpretation would be compatible with the theory that the Babylonian calendar was imposed on Judean society by Antiochus IV and adopted by the Hasmoneans, but is being replaced by the numeric calendar (by 'sectarians' restoring the Qumran-Jubilees calendar). 4Q332 frag 2 lines 2–3 may be an example of such a process. However, if the text were 'sectarian,' why would it use later Hasmonean history as an example to co-ordinate the ancient 364-day calendar with the Babylonian calendar given that it was supposedly rejected by a breakaway group? Similarly, Eshel argued that 4Q332 could not be sectarian because of the presence of the Aramaic-Babylonian month name.[436] 4Q332 seems to be quite neutal with regards to the dual-dating system.

It may be that no firm conclusion can be drawn from the order of calendrical notation in 4Q332 without detailed speculation. Suffice it to say that double dating between two different calendar traditions existed in this historical text from Qumran with respect to the Babylonian calendar and the numerical calendar, and that this was also a literary practice in the late biblical books.

Finally, coincidentally, there are two months of Shevat inscribed in the Dead Sea Scrolls: in *4QZodiac Calendar* (4Q318 col. vii line 4 שבט)[437] and *4QHistorical Text D* (4Q332 frag 1 line 2 שבט).[438] Paleographically, the *šin* and *bet* in שבט in 4Q332 frag 2 line 2[439] are similar to those in 4Q318 col. vii line 4 (the right hand of the largest fragment). Magnification of שבט online on the digitised Dead Sea Scrolls database is recommended, the links are below.).[440] The *ṭet* in "Shevat" in both texts has the top of its right down stroke curved backwards into an ornamental loop (4Q318 col. vii line 4). The same distinctive right-side loop on the *ṭet* is visible in סרטנא "Cancer" in 4Q318 col. vii line 4 line 6 (first extant

436 H. Eshel, *The Dead Sea Scrolls and the Hasmonean State* (SDSSRL; Grand Rapids, MI: Eerdmans; Jerusalem: Ben-Zvi, 2008), 136 n. 9.

437 See 4Q318 on line, http://www.deadseascrolls.org.il/explore-the-archive/image/B-280112 (Taken January 1955. Plate 805. B-2801112. PAM number M. 41.696. Photographer Najib Anton Albana).

438 See 4Q332 (*4QHistorical Text D*), online, http://www.deadseascrolls.org.il/explore-the-archive/image/B-365510 (Plate 694, B-365510). Note that the titles 4Q332 Fragment 2 and Fragment 1 are transposed (accessed April 05, 2014) so Frag 2 is labelled Frag 1 in contrast to the arrangement in other current printed and electronic versions.

439 Fitzmyer, DJD 36, 4Q332. *4QHistorical Text D*, pl. 17. (PAM 43.336. Mus. Inv. 694).

440 Greenfield and Sokoloff; Yardeni, DJD 36, 4Q318, 4QZodiology and Brontology ar pl. 15 for col. nos. reproduced here as Figure 1.4. See also, Figures 1.1, 1.2, 1.3, 1.5, 1.6., Yardeni, DJD 36, "318. 4QZodiology and Brontology ar." Paleographical chart. pl. 16.

word), and in סרטנא "Cancer" in 4Q318 col. vii line 4 line 1, although here the *nun* crosses the left arm of the *ṭet* the ornamental loop is unmistakable. Other similarities in the handwriting style between 4Q332 frag 2 and 4Q318 include the distinctive, *lamed* decorated with a large jot on the top of its neck in 4Q332 frag 2 lines 1, 2, 5 and in 4Q318 vii line 9, and elsewhere.[441] Both texts are from the same time period and aside from the particular orthographic difference of the final *mem*, they are not paleographically dissimiliar. This raises the question of whether the texts were produced by the same, or a related hand. If so, it could mean that the Aramaic-Babylonian month names may have interested a very small circle at Qumran (if not just one scribe) and that the copyist of 4Q318 may have known both Hebrew and Aramaic, and so was possibly bilingual.

To summarise, the Aramaic-Babylonian month names in *4QZodiac Calendar* are unique in an Aramaic text at Qumran; they appear in a contemporaneous Hebrew scroll, *4QHistorical Text D*, (4Q332, frag 2 line 2) in the context of double-dating a Babylonian date with a numeric date. The ordinal date in *4QHistorical Text D* is damaged. It cannot be ascertained whether the Babylonian calendar in the Hebrew text is the standard Mesopotamian calendar or the 360-day calendar. The double-dating of a Babylonian month name and a numerical month could indicate that (a) the Babylonian month name was unfamiliar and was being introduced, an interpretation that is interesting given the antiquity of the Babylonian calendar; b) the Babylonian month name was the more familiar and the numerical month was being introduced; this interpretation is also difficult to support because the basic calendars of the priestly services may have been known. It is also possible that c) double-dating was simply the custom in a multiple-calendar society and that this documentary tradition is reflected in a historical text which contains a past narrative from a different period and milieu to the text's intended audience. As J.J. Collins notes, the text does not treat the two calendar systems (particularly given that one is the Babylonian calendar) in a polemical way.[442] There could also be a pedagogical element to the dual dating system in that it may function as a calendar conversion, from one system into another. It is possible to contend that the calendars are equal but different.

It was observed that the handwriting in *4QZodiac Calendar* and *4QHistorical Text D* was very similar, particularly the distinctive *ṭet* in the month name Shevat in 4Q318 (and the zodiac sign name of Cancer) and 4Q332, and the undamaged *lamed*, in 4Q332 frag. 2 and 4Q318 col. viii, line 9. This may imply that both texts, one Aramaic, and one Hebrew, were written by the same hand,

441 Described by Yardeni as a triangular loop on the top left corner of the "mast", in DJD 36, 261.

442 Collins, "Historiography," 175.

or they may have emanated from the same school. Taking on board the larger proportion of different types of texts that survived, the existence of two manuscripts with the same month names that have paleographical similarities may suggest that 4Q318 was a specialist text, rather than an oddity, or some kind of foreign object in Cave 4. I would argue that Greenfield and Sokoloff did not give due weight to the content of 4Q318 and its relationship with other scrolls at Qumran, including *4QZodiacal Physiognomy* and instead placed an over-emphasis on the fact that it was written in Aramaic and deemed non-sectarian.[443] In this way it has been marginalised as an "isolated" text.[444]

By itself, it is feasible that 4Q318 was brought into Qumran from the outside, especially as it is a small scroll. However, if *4QHistorical Text D* was written by the same person or an associate, 4Q318 and 4Q332 could reflect part of a culture that was interested in different calendrical systems involving the Aramaic translations of Babylonian calendar month names, the zodiac, the reading of thunder omens and astrology.

For the historical and cultural reasons outlined, it is unlikely that the Babylonian calendar was unknown in the circles that organised the collection. Due to the fact that fragments of two texts with the Aramaic-Babylonian month names were found in the Dead Sea Scrolls, 4Q318 and 4Q332, the latter a Hebrew text that also uses the calendars of the priestly courses, the theory that the community responsible for compiling and preserving the Dead Sea Scrolls rejected the Babylonian calendar should be reevaluated. In the next section I discuss the remains of *4QZodiac Calendar* and present a full textual reconstruction of 4Q318 columns i to viii line 6a based on the extant parchment fragments.

1.7 Material Description and Measurements

The Dead Sea Scrolls provide a rare opportunity for researchers to study 2,000 year-old primary source epigraphic materials from Judea in their original ancient state. I examined 4Q318 from photographs, microfiches, CD-ROMs, and with a microscope at the Israel Antiquities Authority's laboratory in Jerusalem. Since December 2012, the scrolls have been accessible online enabling magnification, thereby preserving the scrolls and making this work so much easier for scholars. There is a great difference between the photographic plates of

443 See also Dimant, "Themes and Genres in the Aramaic Texts from Qumran," "Discussion," in *Aramaica Qumranica*, 43. She argues that 4Q318 is different in "content, literary character and purpose," from the other Aramaic texts in the Dead Sea Scrolls.

444 Dimant, "Themes and Genres," *Aramaica Qumranica*, 42, and "Discussion," 43–44.

the scroll taken in the 1950s and in 1960s, and its condition today, which has deteriorated considerably, as shown in the unpublished photograph taken in 2001 and the online digital colour image taken in 2004.[445] This section will describe the scroll, trace the history of its material reconstruction, and offer a textual restoration based on the fragments pictured in the earliest photographs.

4Q318 is a small, creamy-grey parchment scroll; only two columns 4Q318 cols. vii–viii are substantially partially extant today. The second largest fragment, 4Q318 col. iv lines 5–9 consisting of five lines, is now dark brown and illegible. (The column numbers were designated in the critical edition by Greenfield and Sokoloff by reconstructing the text horizontally, as noted earlier; however, the textual material reconstruction here agrees with these column numbers by restoring the text vertically, as shown in the last sub-section.) This fragment, col. iv, will be described separately, below.

The main block, composed of cols. vii and viii, is 8.3 cms in height. It consists of nine guidelines with c. 8 mm between the guidelines and an upper margin of 1 cm from the top of the block to the first guideline, and a lower margin of 1 cm from the ninth guideline to the bottom edge of the parchment.[446] According to Tov, the definition of a "small composition" is up to 10 lines.[447] 4Q318 would therefore come into this category. It is a portable scroll of a convenient size when rolled, therefore, easily transported.[448]

The column widths of the main block are 11.5 cm with a margin of 1.5 cm between the two columns. The left margin in col. viii is missing entirely, and part of the margin from col. vi is extant (from the top margin to line 4). The

445 See Figures 1.1–1.6, § 1.7.2, pp. 161–164, for copies of images: PAM 41.696 (June 1955); PAM 42.423 (May 1957) [this is the image used for 4Q318 in the *Dead Sea Scrolls Electronic Library* (DSSEL) (ed. E. Tov; Leiden: Brill, 2006)]; PAM 43.374 (April 1960); DJD 36, pl. 15 (2000); unpublished IAA Report 1–744883 (March 2001) and the colour image B-6741 (28 April 2004), Photo: Tsila Sagiv; PAM: abbrev. Palestine Archaeological Museum (now called the Rockefeller Museum).

The online archive has slightly different PAM numbering and the dates for the 1955 and 1957 images are given as January. At the time of writing it does not have the image taken in March 2001. Online. Accessed 2 July 2014: The Leon Levy Dead Sea Scrolls Digital Library (4Q318 page) http://www.deadseascrolls.org.il/explore-the-archive/manuscript/4Q318–1.

446 Sokoloff and Greenfield, DJD 36, 259–60; Tov, *Scribal Practices*, 90, Table 15, lists 4Q318 as 10 cm in height; this is an error (10 cm is the width of the written text).

447 Tov, *Scribal Practices*, 90.

448 Tov cites (op. cit.): T. Birt, *Kritik und Hermeneutik nebst Abriss des Antiken Buchwesens* (Munich: C.H. Beck, 1913), 349. Accessed 11 June 2014. Online: http://www.archive.org/stream/kritikundhermeneo0birtuoft. Birt observed that some classical texts were excerpted due to their length and noted that travellers preferred to carry smaller versions.

written area in each column is 6.3 cm (height) by 10 cm (width). The text in col. vii runs into the left hand margin substantially in line 1, and partially or slightly in extant lines 7–8. There is a blank space before the month name, שבט Shevat, in col. vii line 4 on the same line.

There is also a blank space before the next month, אדר Adar, at the end of the previous column. Adar begins at the top of col. viii; the preceding blank space is on line 9, col. vii. It appears that rather than begin אדר Adar at the end of the column, the scribe has chosen to leave the remainder of line 9 clear, after the completion of the month of Shevat. Yardeni points out that the text is divided according to content; the spaces at the beginning, middle or end of lines mark the start or completion of textual units.[449] By "beginning," Yardeni must refer to the end of the zodiac calendar at col. viii 6, which is completed by דכרא "Aries," on Day 30, the final sign of the moon in the calendar, and a half-line *vacat*, followed by the opening sentence of the brontologion on the same line. There are no spaces between the text and the right-hand margin.

1.7.1 *Column iv of* 4QZodiac Calendar

Due to the amount of detail involved in describing the material remains of the Qumran zodiac calendar and the accompanying issues involved in its reconstruction, the smaller fragment of col. iv, now dark and illegible, is here described separately. (The content is visible only on the images taken in the 1950s and 1960s). A major part of the sequence of reconstructing *4QZodiac Calendar* lies in the restoration of the smaller fragment 4Q318 col. iv, which I argue was probably originally wider than cols. vii and viii.[450]

The five-line fragment contains two dates per line; the remains of the fourth line is uninscribed. The blank space takes the form of a slightly deeper space between guidelines. The depth of the space between lines 8–9 is 1 cm, instead of the usual 8 mm space between guidelines. As a result, the bottom margin of col. iv is 2 mm shorter than that of cols. vii and viii. The space between the ninth guideline and the bottom edge of the parchment is 8 mm, in comparison with cols. vii and viii where it is 1 cm.

The month of Tishri (תשרי) starts at col. iv line 9 in the restored text (see Table 1.7.3 on pp. 170–171). It should be noted that col. iv lines 5–6 has been so-placed on material grounds. It is not attached in the photograph PAM 41.696 (photo taken in 1955, see p. 161) but it is in PAM 42.423 (1957) (see p. 162). A tiny fragment hanging from col. iv has been reattached to col. iv lines 7–8. It appears to have the remains of the bottom, left-hand, outer, and inner circular curves of

449 Yardeni, DJD 36, 260.

450 The critical edition of the reconstruction of col. iv is Greenfield and Sokoloff, DJD 36, 262.

the manuscript's distinctive letter *ṭet*, or the top right-hand and middle arms of the letter *šin* (or, a mirror-image of either).[451] However, it is improbable that it is the remains of the letter *ṭet* from סרטנא or the *šin* from תשרי, because neither of those words is likely to have been in that position. The conservationist at the IAA laboratory thought that these apparent ink strokes were dirt because the marks did not appear in the infra-red photograph.[452] This newly attached piece is not as dark as the remainder of the fragment.

The extant text (from plates PAM.41.696 {1955},[453] 42.423 {1957},[454] 43.374 {1960})[455] is very clear: col. iv line 9: גדיא, "Capricorn, on the 8th . . ." is beneath the 1 cm full *vacat*: line 8 of the fragment. Above this, the date is on line 7: "on the 28th and on the 29th." The attached fragment, line 6, has a certain "on the 20," (PAM. 42.423 {1957}, PAM. 43.374 {1960} only) so the dates on either side would be "on the 19th and on the 21st."

Line 5 of this attached fragment: "on the 13th" has three number digits, short down strokes ///, and the remains of a character, which most clearly fits the top curve of the Aramaic, symbol for the number 20 (like the Arabic ordinal for number 3 tipped forwards). The arrangement of the dates in col. iv, as reconstructed, is determined by the extant text, which has been placed as col. iv lines 5–9. If the attached fragment is correctly placed, the result means that col. iv may be wider than the extant cols. vii and viii. Lines 5–7, 9 would have c. 77 characters per line, compared to c.65 characters per line in cols. vii and viii. This makes col. iv 1.5 cms wider than cols. vii and vii, which is the width of another margin. It is possible that col. iv was a different piece of leather to cols. vii and viii, which may explain the difference; the reattached fragment fits on material grounds. According to Stegemann, a column in the middle of a sheet can be wider or narrower, depending on how the columns were scored:

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451 See Yardeni, DJD 36, 259–261, pl. 16. A mirror image can be caused by the impression of fresh ink on rolled, or folded paper, or leather.

452 See Figure 1.5 for the copy of the image Report 1–744883 (2001). The possible letters discussed are visible on the left side of col. iv.

453 PAM 41.696 (1955), Tov with Pfann, *Companion Volume*, 84; R. Eisenman and J. Robinson, *A Facsimile Edition of the Dead Sea Scrolls* (2 vols; Washington: Biblical Archaeological Society, 1991), pl. 397.

454 PAM 42.423 (May 1957), Tov with Pfann, *Companion Volume*, 86; Eisenman and Robinson, *A Facsimile Edition*, pl. 848; published by J. C Greenfield and M. Sokoloff, "An Astrological Text from Qumran (4Q318) and Reflections on Some Zodiacal Names," *RevQ* 16 (1995): pl. 6, 525. A different version of it, with frags. 4 and 5 apparently cut out and printed below, was published in DJD 36, pl. 15; DSSEL (s.v. 4Q318).

455 PAM 43.374 (1960), Tov with Pfann, *Companion Volume*, 91; published by Eisenman and Wise, *Dead Sea Scrolls Uncovered* (1992), pl. 23.

outwards from a seam, or inwards towards the seam.[456] This column would be one-third into the scroll.

1.7.2 *Material Reconstruction: Published and Unpublished Reports*

In this sub-section I will review and compare all the photographs taken of 4Q318, including a late unpublished image, the digitised photograph, and the representation of the scroll in the critical edition. The review of all the extant visual material for the remains of the scroll, about one-sixth of the whole, was helpful in making a hypothetical textual reconstruction of *4QZodiac Calendar*. The images tell their own story of the background of the restoration of scroll fragments. The text is easy to read on the first photographs: Figure 1.1: PAM. 41.696 (1955); Figure 1.2: PAM. 42.423 (1957); Figure 1.3: PAM. 43.374 (1960). Dark brown spots have appeared on the surface more recently and there is evidence of delamination; see Figure 1.5: Report 1–744883 (2001), and Figure 1.6: digital photo online (2004).[457]

The image used in DJD 36, pl. 15 (designed "PAM. 42.423" in the critical edition) was not found in the IAA archives nor does it appear under that plate number in the records. The numbering of fragments 1 to 5 beneath the main cols. vii and viii in DJD 36, pl. 15, (Figure 1.4) although confusing (fragments 4

FIGURE 1.1 *4Q318 (4QZodiac Calendar and Brontologion). PAM 41.696 (1955) Courtesy of the Israel Antiquities Authority.*

456 H. Stegemann, "Methods for the Reconstruction of Scrolls from Scattered Fragments," in *Archaeology and History in the Dead Sea* (ed. L.H. Schiffman; JSPSSupplement 8; Sheffield: JSOT, 1990), 189–220 (esp. 198).

457 I thank Yael Barschak of the IAA Photographic Archives for her kind assistance.

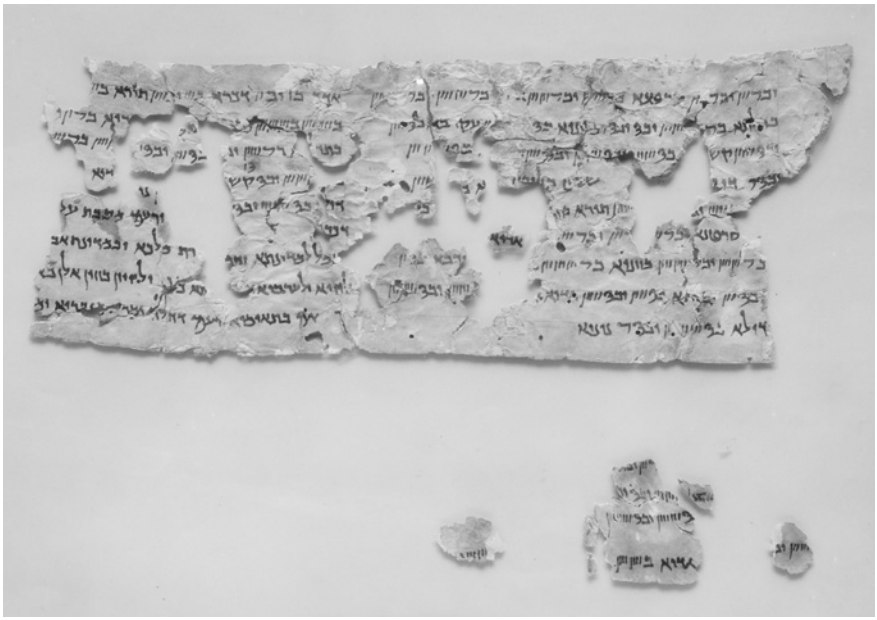

FIGURE 1.2 *4Q318 (4QZodiac Calendar and Brontologion). PAM 42.423 (1957) Courtesy of the Israel Antiquities Authority.*

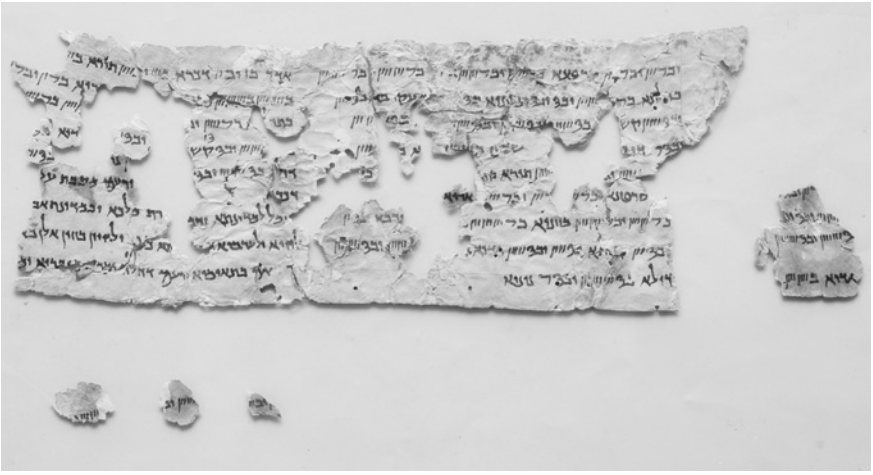

FIGURE 1.3 *4Q318 (4QZodiac Calendar and Brontologion). PAM 43.374 (1960) Courtesy of the Israel Antiquities Authority.*

FIGURE 1.4 *4Q318 (4QZodiac Calendar and Brontologion). Image in DJD 36, Plate 15 (2000) listed as 'PAM 43.374'.*

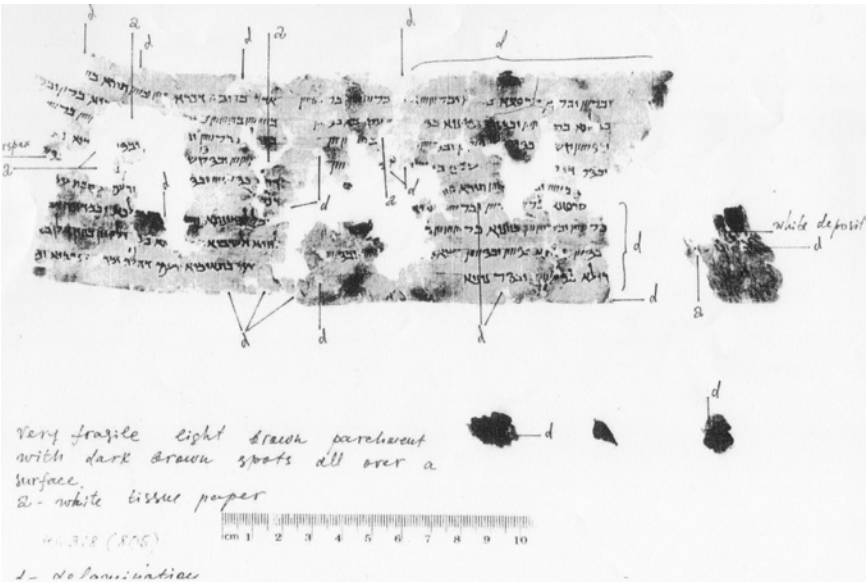

FIGURE 1.5 *4Q318 (4QZodiac Calendar and Brontologion). Unpublished Israel Museum Report. 1–744883 (March, 2001) Courtesy of the Israel Antiquities Authority.*

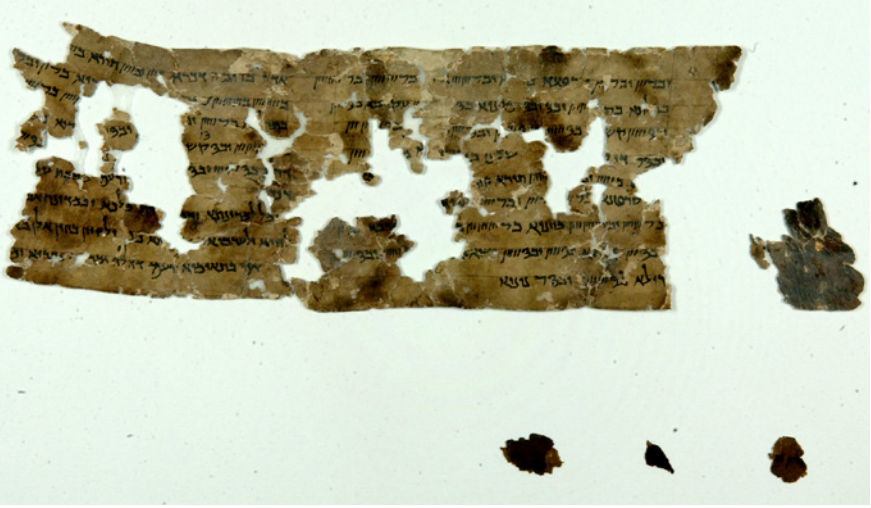

FIGURE 1.6 *4Q318 (4QZodiac Calendar and Brontologion). (B-6741, 28 April 2004) in colour. Photo Tsila Sagiv Courtesy of the Israel Antiquities Authority.*

and 5 are placed in the main text in Figure 1.2: PAM. 42.423 {1957}), it enables one to trace the material reconstruction process. The fragment numbers used in DJD 36, pl. 15, are here used as reference points throughout this section. In PAM 42.423 (1957), frags. 5 and 4 have been attached and frag. 2 has been placed on the right of col. iv line 6 (but upside down).

The earliest visual record, PAM 41.696 (1955), lacks col. iv lines 5–6 completely; the latest fully readable version, PAM 43.374 (1960), has three unattached fragments: frags. 3, 2, 1, which are now black (see Figures 1.5 and 1.6), having remained unplaced. The position of frags. 4 and 5 are in situ (but in different places) in PAM 42.423 (1957) and PAM 43.374 (1960). The following summary lists the material reconstruction records. A description of the position of the loose fragments at each stage of the process is followed by a detailed description of where the tinier pieces were placed during the course of decades of reconstruction and conservation:

- Figure 1.1: PAM 41.696 (1955). This consists of the larger fragment containing col. vii and vii and col. iv (bottom far right) with four then-unplaced fragments.
  The photo includes an upside-down fragment to the left of col. iv, which has been placed the right way up in Figure 1.2: PAM. 42.423, col. iv lines 5–6. The image on the microfiche is very brown. Fragments with words are already placed, indicating that in 1955 when the photograph had been taken,

a rudimentary reconstruction of the order of the signs of the zodiac had been made on the basis of the extant remains. The fragments with words (as opposed to those with number signs) include Leo, אירא, placed in col. vii 5 (instead of line 6); and the beginning of Vi]rgo:]ותב, in col. viii 3.

- Figure 1.2: PAM 42.423 (1957). Col. iv has been attached to col iv lines 5–6. The tiny frag 2 has been placed upside down to the top right of col iv. Frags. 5 and 4 have been attached to col. viii.
  Frag. 5 (/3וב, (on the 21st) has been placed *in front of* frag. 4 /˙ //3ב (]on the 22nd [3rd) viii line 3; both are misplaced. Milik attached the fragment on the plate next to col. iv, aligned with col. iv lines 5–6 by matching the edges of the leather. Frags. 1 and 3 (on either side of col. 4) remain unplaced. Leo, אריא, has been placed in col. vii line 6.
- Figure 1.3: PAM 43.374 (1960). Frags. 5 and 4 in col. viii have been rearranged from Figure 1.2: PAM. 42.423 (1957).
  Milik has moved frag. 4 to the end of col. viii line 5, but it is still misplaced (see *Textual reconstruction*, p. 174); frag. 5 has been resituated to viii line 4, but it is also misplaced because there is already a supralinear '21st' on that line (as a scribal correction; it is without the prefixes וב). Col. iv has been moved to the right of cols. vii and viii, suggesting that the zodiacal reconstruction was more secure.
- Figure 1.4: "PAM 42.423" (Greenfield and Sokoloff, DJD 36, pl. 15 {2000}). The photo is not extant in the Facsimile and there is no record of this image in the IAA archives or online;[458] it appears to be an adaptation in order to aid identification of fragments for scholarly purposes.
  Greenfield and Sokoloff reproduced "PAM. 43.374" with frags 1 to 5 beneath the columns, although frags. 4 and 5 had been placed (see PAM 42.423 {1957} above). In so doing, they demonstrated part of the history of the textual reconstruction.
- Figure 1.5: **Report 1–744883** (March 2001), unpublished. Frags. 5 and 4 are here attached, as in PAM. 43.374 {1960}. There are 3 loose unplaced frags., now black. Col. iv is dark brown. Delamination and dark spots now on cols. vii and viii.
  The main differences between this report and Figure 1.6: (2004) and Figure 1.3 are that in Figure 1.5 and Figure 1.6 the tiny, hanging fragment on the left side of col. iv has been reattached and the three remaining, unplaced fragments have been placed in a different position in the glass plates. They have turned dark brown in the later photograph, as has col. iv. There are dark spots in cols. vii and viii.

458 Confirmed by Yael Barschak at the IAA Photographic Archives.

A facsimile of 4Q318 entitled "Brontologion" before its deterioration is on display in the Shrine of the Book, Jerusalem, because the original is too fragile to be exhibited.[459]

1.7.3 *Textual Reconstruction of* 4QZodiac Calendar

This sub-section will focus on a suggested material reconstruction of the text of the zodiac calendar by following the zodiacal arrangement in the part-extant cols. iv, vii and viii. Greenfield and Sokoloff did not reconstruct the missing columns of the scroll, nor the fragment, col. iv. Table 1.7.3 is a suggested reconstruction of the complete zodiac calendar, following the pattern of the moon's sojourn in each zodiac sign in the part-extant cols vii and viii. In order to reach a satisfactory solution, it has been necessary to leave the possible first line of the scroll free, as will be explained below.

4QBrontologion assigns almost three lines to thunder in Taurus (4Q318 col. viii lines 6–8), and Gemini is incomplete at one line (4Q318 col. viii line 9). Assuming that each omen protasis-apodosis takes up about 2.5 lines per zodiac sign, as is the case with the sign of Taurus at 4Q318 col. viii line 6–8, that would mean the brontologion would consist of 30 lines, which is an additional 26.5 lines (10 more signs, plus another 1.5 lines for thunder in Gemini). If each column of the scroll consisted of nine lines, there would be an extra three full columns or 27 lines. However, allowing for each protasis ("If it thunders in zodiac sign *X*") to begin on a new line, the brontologion could go into a fourth column.

In the reconstruction of Table 1.7.3, *4QZodiac Calendar* takes up eight columns, thus the entire scroll for one year containing the complete *4QZodiac Calendar* and *4QBrontologion* would probably comprise 12 columns. The original length of the scroll would be c. 1.38 m (11.5 cm per column × 12). No other zodiac fragments for different years have been found; therefore, it would be speculative to suggest that the scroll comprised a possible three-year ephemeris, in comparison with the triennial cycle of the priestly courses at Qumran.

In addition to the question of the number of years, the actual length of *4QZodiac Calendar* is uncertain because it is not known if the text began at restored col. i line 1. If one replicated the arrangement of the surviving text to the other months, assuming that all the relevant columns except col. iv (discussed above) were the same width as cols. vii and viii, there would be a shortfall of two-to-three lines at the presumed beginning of the calendar in Nisan. One option to solve the problem of the excess space would be to leave a very spacious title-heading at the top of col. i, but nothing similar is attested

459 Oral communication at the IAA in April 2008.

in other scrolls.[460] Another solution to this problem would be to leave space either for an uninscribed top line, or for a prologue.

Column vii begins with the extant "on the 13th and on the 14th, Cancer . . ." (in Tevet, Month x). Thus, the previous column, col. vi, line 9 must end at "on the 12th" (in Tevet). Even if "Capricorn; on the 8th" (in Tishri) in col. iv were placed at the end of the column on the bottom margin, the amount of available space—between "Capricorn; on the 8th" in Tishri and "on the 13th and on the 14th, Cancer" in Tevet—is very large. There are two columns separating the dates: that is, 18 lines with space for 108 dates, with an average of about six—to—eight dates per line. This is very generous, as there are only 93 dates to fill the space.

Excluding *vacats*, there would be c. 40–60 characters per line, which is very loose. Some lines would fall 1.5 cm short of the left-hand margin, but the extant text does not do this. As a title of a scroll at the top of a column is unattested at Qumran, it could be that one column is two lines shorter than the rest, which would take up the slack.[461] The problem, then, would be to identify which columns could have had fewer lines.

It is noticeable that 4Q318 col. vii line 1 begins mid-month, on the 13th and 14th of Tevet at around the full moon and that the month of Adar, begins at the top of col. vii, on days 1 and 2. I considered restoring the text on the basis that the top of the columns alternated between beginning mid-month and the beginning of the month. However, it was not possible to reconstruct *4QZodiac Calendar* with the extant text either by beginning col. 1 with Nisan followed by the first half of Iyyar in the same column, or by beginning col. 1 with Nisan midway through the sheet so that the column contained just one month.

After several trials and errors, the text was most satisfactorily restored to fit in with the existing fragments by incorporating an uninscribed first line (or it could have contained a preamble) and a top margin. This would not be unusual: a blank first line and top margin is attested in *4QWords of Judgement* (4Q238)[462] and possibly, in *4QUnidentified Text* (4Q332a),[463] for example. The reconstruction in Table 1.7.3, follows the extant arrangement in cols. vii and viii of one zodiac sign for two days, the next sign for the following two days and the

460 Titles are usually taken to be the first words in the running text, or written on the outside of the scroll, at Qumran: E. Tov, *Scribal Practices*, 118–121.

461 H. Stegemann, "Methods for the Reconstruction of Scrolls from Scattered Fragments," 198.

462 P. Flint, 4Q238: Plate 40 (PAM 43.399) in *Qumran Cave 4 28: Miscellanea*, Part 2 (eds. M. Bernstein et al., DJD 28; Oxford: Clarendon, 2001). Flint dates *4QWords of Judgement* from the late Hasmonean to the early Herodian period (50–1 B.C.E.), 120.

463 E.J.C. Tigchelaar, "332a. 4QUnidentified Text," DJD 28, 129, pl. 41.

subsequent sign for the next three days, repeated in that pattern for 12 months of 30 days each. The mean number of characters in each line in cols. i—iii, and v—vi is the same as that in the extant columns, cols. vii and viii. As suggested in the last sub-section, col. iv is wider than the other columns, as intimated by the surviving text.

Each new month was restored as a new textual unit separated by closed paragraphs: a blank space on the same line,[464] as is the case with the extant text of cols. vii lines 4, 9 and viii line 6. The suggested restoration does not take into account the possibility that non-extant columns may be of a different width to cols. vii and viii, nor that the *4QZodiac Calendar* may consist of more than one year.

TABLE 1.7.3 *Textual reconstruction of* 4QZodiac Calendar

4Q318 i 1–9: (1 Nisan–16 Iyyar). Reconstruction.

1	*Top margin plus uninscribed first line*	
2	[ניסן ב/ וב//תורא ב/// וב/// תומיא ב///// וב////// וב////// סרטנא	]
3	[ב/////// וב////////אריא ב¬ וב¬/ בתולתא ב¬// וב¬/// וב¬////	]
4	[מוזניא ב¬///// וב¬////// עקרבא ב¬/////// וב¬//////// קשתא	]
5	[ב¬//////// וב3 וב3/גדיא ב3// וב3/// דולא ב3/// וב3/////	]
6	[נוניא ב3////// וב3/////// וב3//////// דכרא ב3////////	]
7	[וב3¬תורא *vacat* אייר ב/ וב// תומיא ב/// וב////	]
8	[סרטנא ב///// וב////// וב/////// אריא ב/////// וב//////// בתולתא ב¬	]
9	[וב¬/מוזניא ב¬// וב¬/// וב¬//// עקרבא ב¬///// וב¬////// קשתא	]

4Q318 i 1–9: (1 Nisan–2 Iyyar). Reconstruction and Translation

1 *First line blank*
2 [Nisan. On the 1st and on the 2nd, Taurus; on the 3rd and on the 4th, Gemini; on the 5th and the 6th and on the 7th, Cancer;]
3 [on the 8th and on the 9th, Leo; on the 10th and on the 11th, Virgo, on the 12, 13th and 14th]
4 [Libra; on the 15th and 16th, Scorpio; on the 17th and 18th, Sagittarius;]
5 [on the 19th, and on the 20th and on the 21st, Capricorn; on the 22nd and on the 23rd, Aquarius; on the 24th and on the 25th]

464 E. Tov, *Textual Criticism*, 50–53, 216.

6 [Pisces; on the 26th, and on the 27th and on the 28th, Aries; on the 29th]
7 [and on the 30th, Taurus *vacat* Iyyar. On the 1st and on the 2nd, Gemini; on the 3rd and on the 4th]
8 [Cancer; on the 5th and on the 6th and on the 7th, Leo; on the 8th and on the 9th, Virgo; on the 10th]
9 [and on the 11th, Libra; and the 12th and on the 13th and on the 14th; Scorpio; on the 15th and on the 16th, Sagittarius;]

4Q318 ii 1–9: (17 Iyyar–30 Sivan). Reconstruction.

1 [ב¬////// וב¬/////////גדיא ב¬//////// וב3 וב3/ דולא ב3//]
2 [וב3/// נוניא ב3//// וב3///// דכרא ב3////// וב3/////// וב3////////]
3 [תורא ב3//////// וב3¬תומיא *vacat*]
4 [סיון ב/ וב// סרטנא ב/// וב/// אריא ב///// וב////// וב/////// בתולתא]
5 [ב//////// וב//////// מוזניא ב¬ וב¬/עקרבא ב¬// וב¬/// וב¬////]
6 [קשתא ב¬///// וב¬////// גדיא ב¬/////// וב¬//////// דולא]
7 [ב¬//////// וב3 וב3/נוניא ב3// וב3/// דכרא ב3//// וב3/////]
8 [תורא ב3////// וב3/////// וב3/////// תומיא ב3//////// וב3¬]
9 [סרטנא *vacat*]

4Q318 ii 1–9: (3 Iyyar–30 Sivan). Reconstruction and Translation.

1 [on the 17th and on the 18th Capricorn; on the 19th and on the 20th and the 21st, Aquarius; on the 22nd]
2 [and on the 23rd, Pisces; on the 24th and on the 25th, Aries; on the 26th and on the 27th and on the 28th,]
3 [Taurus; 29th and on the 30th, Gemini. *vacat*]
4 [Sivan. On the 1st and on the 2nd, Cancer; on the 3rd and on the 4th, Leo; on the 5th and on the 6th and on the 7th, Scorpio.]
5 [on the 8th and on the 9th, Libra; on the 10th and on the 11th, Scorpio; on the 12th and on the 13th and on the 14th,]
6 [Sagittarius; on the 15th and on the 16th, Capricorn; on the 17th and on the 18th, Aquarius;]
7 [on the 19th and on the 20th and the 21st, Pisces; on the 22nd and on the 23rd, Aries; on the 24th and on the 25th]
8 [Taurus; on the 26th, and on the 27th and on the 28th, Gemini; on the 29th and on the 30th,]
9 [Cancer. *vacat*]

TABLE 1.7.3 (*cont.*)

4Q318 iii 1–9: (*1 Tammuz–22 Av*). *Reconstruction.*

1 [תמוז ב/ וב// אריא ב/// וב//// בתולתא ב///// וב////// וב/////// מוזניא]
2 [ב/////// וב//////// עקרבא ב¬ וב¬/ קשתא ב¬// וב¬/// וב¬////]
3 [גדיא ב¬///// וב¬////// דולא ב¬/////// וב¬/////// נוניא]
4 [ב¬//////// וב3 וב3/ דכרא ב3// וב3/// תורא ב3////]
5 [וב3///// תומיא ב3////// וב3/////// וב3/////// סרטנא ב3//////// וב3¬]
6 [אריא *vacat* אב ב/ וב// בתולתא ב/// וב////]
7 [מוזניא ב///// וב////// וב/////// עקרבא ב /////// וב//////// קשתא ב¬]
8 [וב¬/ גדיא ב¬// וב¬/// וב¬//// דולא ב¬///// וב¬////// נוניא]
9 [ב¬/////// וב¬/////// דכרא ב¬//////// וב3 וב3/ תורא ב3//]

4Q318 iii 1–9: (*1 Tammuz–22 Av*). *Reconstruction and Translation*

1 [Tammuz. On the 1st and on the 2nd, Leo; on the 3rd and on the 4th, Virgo; on the 5th and on the 6th and on the 7th, Libra;]
2 [on the 8th and on the 9th, Scorpio; on the 10th and on the 11th, Sagittarius; on the 12th and on the 13th and on the 14th,]
3 [Capricorn; on the 15th and on the 16th, Aquarius; on the 17th and on the 18th, Pisces;]
4 [on the 19th and on the 20th and on the 21st, Aries; on the 22nd and on the 23rd, Taurus; on the 24th]
5 [and on the 25th, Gemini; on the 26th and on the 27th and on the 28th, Cancer; on the 29th and on the 30th,]
6 [Leo. *vacat* Av. On the 1st and on the 2nd, Virgo; on the 3rd and on the 4th,]
7 [Libra; on the 5th and on the 6th and on the 7th, Scorpio; on the 8th and on the 9th, Sagittarius; on the 10th]
8 [and on the 11th, Capricorn; on the 12th on the 13th and on the 14th, Aquarius; on the 15th and on the 16th, Pisces;]
9 [on the 17th and on the 18th, Aries; on the 19th and on the 20th and on the 21st, Taurus; on the 22nd]

4Q318 iv 1–9: (*23 Av– 8 Tishri*). *Part-reconstruction*

1 [וב3/// תאומיא ב3//// וב3///// סרטנא ב3////// וב3/////// וב3////////]
2 [אריא ב3//////// וב3¬ בתולתא *vacat*]
3 [אלול ב/ וב// מוניא ב/// וב//// עקרכא ב///// וב//////]
4 [וב/////// קשתא ב/////// וב//////// גדיא ב¬ וב¬/ דולא ב¬// [ב¬/// וב¬/[///]

5 [נוניא ב¬///// וב¬////// דכרא ב¬/////// וב¬//////// תורא ב¬///]////// וב3 ו]ב3/
6 [תומיא ב3// וב3/// סרטנא ב3//// וב3///// אריא ב3////// וב]3/////// וב3////////
7 [בתולתא ב3//////// וב3¬ מוזניא [ ]
Deep vacat [ ] 8
9 [תשרי ב/ ב// עקרבא ב/// וב//// קשתא ב///// וב////// וב///////]גדיא ב////////

4Q318 iv 1–9: (*23 Av– 8 Tishri*). *Part-reconstruction and Translation.*

1 [and on the 23rd, Gemini; on the 24th and on the 25th, Cancer; on the 26th and on the 27th and on the 28th,]
2 [Leo; on the 29th and on the 30th, Virgo. *vacat*]
3 [Elul. On the 1st and on the 2nd, Libra; on the 3rd and on the 4th, Scorpio; on the 5th and on the 6th,]
4 [and on the 7th, Sagittarius; on the 8th and on the 9th, Capricorn; on the 10th and on the 11th, Aquarius; on the 12th and on the]13th and on the 1[4th,]
5 [Pisces; on the 15th and on the 16th, Aries; on the 17th and on the 18th Taurus; on the 1[9th and on the 20th and on 20th and on the 2[1st,]
6 [Gemini; on the 22nd and the 23rd, Cancer; on the 24th and on the 25th, Leo; on the 26th and on the] 27th and on the 28th
7 [Virgo; on the 29th and on the 30th, Libra.]
8 *Deep vacat*
9 [Tishri. On the 1st and on the 2nd, Scorpio; on the 3rd and on the 4th, Sagittarius; on the 5th and on the 6th and on the 7th,]Capricorn; on the 8th

4Q318 v 1–9 (*9 Tishri–28 Marchesvan*). *Reconstruction*

1 [וב//////// דולא ב¬ וב¬/ נוניא ב¬//ב¬/// וב¬//// [
2 [דכרא ב¬///// וב¬////// תורא ב¬/////// וב¬//////// [
3 [תומיא ב¬//////// וב3 וב3/ סרטנא ב3// וב3/// אריא ב3//// [
4 [וב3///// בתולתא ב3////// וב3/////// וב3/////// מוזניא ב3//////// [
5 [וב3¬עקרבא *vacat* מרחסון ב/ וב// קשתא ב///וב/// [
6 [גדיא ב///// וב////// וב////// דולא ב/////// וב//////// נוניא ב¬ [
7 [וב¬/ דכרא ב¬// ב¬/// וב¬/// תורא ב¬///// וב¬//////תומיא [
8 [ב¬/////// וב¬//////// סרטנא ב¬//////// וב3 וב3/ אריא ב3// [
9 [וב3/// בתולתא ב3//// וב3///// מוזניא ב3////// וב3/////// וב3/////// [

4Q318 v 1–9 (*9 Tishri–28 Marchesvan*). *Reconstruction*

1 [on the 9th, Aquarius; on the 10th and on the 11th, Pisces; on the 12th and on the 13th and on the 14th]

TABLE 1.7.3 (*cont.*)

2 [Aries; on the 15th and on the 16th, Taurus; on the 17th and on the 18th]
3 [Gemini; on the 19th, and on the 20th and on the 21st, Cancer; on the 22nd, and on the 23rd, Leo; on the 24th]
4 [and on the 25th, Virgo; on the 26th and on the 27th and on the 28th, Libra; on the 29th]
5 [and on the 30th, Scorpio; *vacat* Marchesvan. On the 1st and on the 2nd, Sagittarius; and on the 3rd and on the 4th,]
6 [Capricorn; on the 5th, on the 6th and on the 7th, Aquarius; on the 8th and on the 9th, Pisces; on the 10th]
7 [and on the 11th, Aries; on the 12th and on the 13th and on the 14th, Taurus; on the 15th and on the 16th, Gemini;]
8 [on the 17th and on the 18th, Cancer; on the 19th and on the 20th and on the 21st, Leo; on the 22nd]
9 [and on the 23rd, Virgo; on the 24th and on the 25th, Libra; on the 26th, and on the 27th and on the 28th,]

4Q318 vi 1–9: (*29 Marchesvan–12 Tevet*). *Reconstruction.*

1 [עקרבא ב3//////// וב3¬ קשתא *vacat*]
2 [כסלו ב/ ב// גדיא ב/// וב/// דולא ב///// וב////// וב/////// נוניא]
3 [ב/////// וב//////// דכרא ב¬ וב¬/ תורא ב¬// ב¬/// וב¬////]
4 [תומיא ב¬///// וב¬////// סרטנא ב¬/////// וב¬//////// אריא]
5 [ב¬//////// וב3 וב3/ בתולתא ב3// וב3/// מוזניא ב3//// וב3/////]
6 [עקרבא ב3////// וב3/////// וב3/////// קשתא ב3////////]
7 [וב3¬ גדיא *vacat*]
8 [טבת ב/ ב// דולא ב/// וב/// נוניא ב///// וב////// וב///////]
9 [דכרא ב/////// וב//////// תורא ב¬ וב¬/ תומיא ב¬//]

4Q318 vi 1–9: (*29 Marchesvan–12 Tevet*). *Reconstruction and Translation*

1 [Scorpio; on the 29 and on the 30th, Sagittarius; *vacat*]
2 [Kislev. On the 1st and on the 2nd, Capricorn; on the 3rd and on the 4th, Aquarius; on the 5th, and on the 6th, and on the 7th, Pisces;]
3 [on the 8th and on the 9th, Aries; on the 10th and on the 11th, Taurus; on the 12th and on the 13th and on the 14th,]
4 [Gemini. On the 15th and on the 16th, Cancer; on the 17th and on the 18th, Leo;]
5 [on the 19th and on the 20th and on the 21st, Virgo; on the 22nd and on the 23rd, Libra; on the 24th and on the 25th,]

6 [Scorpio. On the 26th and on the 27th and on the 28th, Sagittarius; on the 29th]
7 [and on the 30th, Capricorn. *vacat*]
8 Tevet. On the 1st and on the 2nd, Aquarius; on the 3rd and on the 4th, Pisces; on the 5th and 6th and the 7th,]
9 Aries. On the 8th and on the 9th, Taurus; on the 10th and on the 11th, Gemini; on the 12th

4Q318 vii 1–9. 13 Tevet–30 Shevat. Part-reconstruction.

1 ב¬///וב¬///// סרטנא ב¬///// וב¬/////אריא ב¬/////// וב¬////////
2 בתולתא ב¬[///]////// וב3 וב3/ מוזניא ב3/// וב///עקרבא ב3////
3 וב3///// ק]שתא ב3/////[/] וב3////// וב3/////// גד [יא] ב3 ////////
4 וב3¬ דול[א *vacat*] שבט ב/ וב// [נוני]א ב[/// ב]////
5 [דכרא ב]///// וב////// וב/////// תורא ב///[///// וב///////// תומיא] ב¬
6 [וב¬] סרטנא ב¬// ב¬//[/ וב¬/]/// אריא[ב¬/////// וב¬//////// בתולתא]
7 ב¬/////// וב¬//////// מוזניא ב¬///////// [וב3 וב3/ ע]קרבא ב3//
8 וב3/// קשתא ב3//// וב3///// גדיא ב[3///// וב]3/////// וב3//////
9 דולא ב3//////// וב3¬ נוניא *vacat*

4Q318 vii 1–9. 13 Tevet–30 Shevat. Reconstruction and Translation

1 on the 13th and on the 14th Cancer; on the 15th and on the 16th, Leo, on the 17th and on the 18th
2 Virgo; on the[1]9th and on the 20th and on the 21st, Libra; on the 22nd and on the 23rd, Scorpio; on the 24th
3 and on the 25th, Sagitt[arius;] on the 2[6th] and on the 27th and on the 28th, Capric[orn]; on the 29th
4 and on the 30th, Aquar[ius]. *vacat* Shevat. On the 1st and on the 2nd, [Pisce]s; on the[3rd and on the] 4th
5 [Aries; on the] 5th and on the[6th and on the]7th, Taurus; and on the 8[th and on the 9th, Gemini;]on the 10th
6 [and on the 11th,] Cancer; on the 12th and on the 1[3th and on the 1]4th, Leo; [on the 15th and on the 16th, Virgo;]
7 on the 17th and on the 18th, Libra; on the 19th [and on the 20th and on the 21st, S]corpio; on the 22nd
8 and on the 23rd, Sagittarius; on the 24th and on the 25th, Capricorn; on the [26th on the]27th and on the 28th,
9 Aquarius; on the 29th and on the 30th, Pisces.

TABLE 1.7.3 (*cont.*)

4Q318 viii 1–6. Adar 1–Adar 30. Part-reconstruction.

1 אדר ב/ וב// דכרא ב/// וב//// תורא ב//[/// וב////// וב/////// תאומיא]
2 ב////////ב/////////]סרטנא ב¬ וב¬/ א]ריא ב¬//]וב¬/// וב¬////]
3 בת[ולתא] ב¬///// וב[¬//////מוזניא ב¬//]///// ב¬///[///// עקרבא]
^3/^
4 [ב¬/]//////// וב3 קש[תא ב3// וב3/// ג]דיא[ב3//// וב3/////]
5 ד]ול[א ב3///// וב3[/////// וב3//////]/ נו[ניא ב3//////// וב3¬]
6 דכר[א] *vacat*
7
8
9

4Q318 viii 1–6. Adar 1–Adar 30. Part-reconstruction and Translation

1 Adar. On the 1st and on the 2nd, Aries; on the 3rd and on the 4th, Taurus; on the 5[th and on the 6th and on the 7th, Gemini;]
2 on the 8th and on the 9th, C[ancer; on the 10th and on the 11th, L]eo; on the 12th [and on the 13th and on the 14th,]
3 Vir[go]; on the 15th and on [the 16th, Libra; on the 1]7th and on the 1[8th, Scorpio;]
^21st^
4 [On the 1]9th, and on the 20th, Sagitt[arius; on the 22nd and on the 23rd, Cap]ricorn; [on the 24th and on the 25th]
5 Aqu[arius]; on the 26th and on the 2[7th and on the 2]8th, Pi[sces; on the 29th and the 30th,]
6 Arie[s.]
7

Interestingly, this method of restoration meant that the wide horizontal space, part of which is extant in col. iv line 8, separated the beginning of the restored Tishri (Month VII) from the previous six months. In comparison, Greenfield and Sokoloff did not leave col. iv line 8 blank, although there is a clearly visible

deep space at that point in the extant fragment,[465] and they began their part-reconstruction of col. iv at line 5. Here, it begins at line 4. Therefore, in this restoration the year is divided into its two halves by an open paragraph (leaving the preceding line blank to create a sub-division). According to my reconstruction, there was also blank line before Nisan (Month I), and part-blank lines before the Tammuz (Month IV) and Tevet (Month X). Hence the four quarters of the year are highlighted. Tammuz begins at the top of restored col. iii. Since this is the month of the summer solstice, this position may be significant, particularly as the extant text for Tevet, the month of the winter solstice, begins at the full moon, at the top of extant col. vii. This reconstruction suggests that the structure of *4QZodiac Calendar* reflects an interest in the four quarters of the year, in addition to its two halves.

1.8 Summary and Conclusion

The probable late Mesopotamian background to the 360-day ideal calendar in the Dead Sea Scrolls was examined and the hypothesis was proposed that it was a portable calendar related to late Babylonian 360-day zodiac calendar traditions. The data in the late Babylonian calendar scheme and *4QZodiac Calendar* were compared with similar information in the Babylonian horoscope corpus. Consequently, I have suggested that the structure of *4QZodiac Calendar* could be accounted for more realistically by comparing it with the 'Dodekatemoria scheme' progressed from that of Brack-Bernsen and Steele in their ground-breaking 2004 paper (by substituting zodiac signs for numbers) than by postulating a connection with MUL.APIN, or a possible *thema mundi*, as proposed by earlier scholars.

The Mesopotamian micro-zodiac traditions were compared to the structure of 4Q318 and I tested the hypothesis that a 360-day zodiac calendar may have been used as a rough rule of thumb to ascertain the zodiacal position of the moon at a given date and time in order to cast horoscopes. It was argued that *4QZodiac Calendar* may be an even more simplified version of the late Babylonian paradigm and that it may have been used as an 'ideal' calendar with the *4QBrontologion* to calibrate the moon's position in the zodiac in different years. It was also suggested that the formula for the king and country

465 Greenfield and Sokoloff, DJD 36, 262. The space above the extant text on col iv line 9 is left as a *vac*]*at*, and they began "Virgo, in 29 and in 30 Libra *vac*]*at* "in the middle of col iv line 8.

given in *4QBrontologion* reflects the style of Mesopotamian omens in which the zodiac sign not only indicated a forecast of destiny, but also represented which nations would be affected by the prediction.

I examined possible lines of diachronic development of the Qumran zodiac sign names, in particular variant names—the earliest known in a primary source—and compared them to those which were attested in Greek and Akkadian. The hypothesis was put forward that a Judean influence might also be considered since the new variant sign names do not contravene biblical law.

My textual restoration of *4QZodiac Calendar* may shed light on the way that the calendrical year was structurally divided by the ancient copyists. Interestingly, the beginning of the second half of the year, Tishri (part-restored) was clarified in the text by a preceding blank line, showing that the calendar year could be treated independently of the schematic astronomical paradigm. Due to the fact that only a single copy of 4Q318 was found at Qumran, it is possible that this small Aramaic manuscript was brought into the community from outside; however there are paleographical and calendrical similarities with the Hebrew annalistic scroll, *4QHistorical Text D* (4Q332), therefore, this question may be left open. It is also possible that there was one scribe, or scribes who were connected in some way, who knew both Aramaic and Hebrew, possessed scientific knowledge which originated in Mesopotamia, and who could have copied 4Q318 either within or outside of Qumran. The double-dating, as noted by Jaubert, and Glessmer, has important implications for the attitude towards calendrical plurality in Second Temple Judaism.

It was demonstrated empirically that 4Q318 is calibrated to the year following the intercalation of a month and I suggested that Babylonian astrologers used an *aide memoire* to help them work out the moon's position in the zodiac, data based on the Uruk scheme, and that this could have been used by the practitioners of 4Q318. It was thus argued that 4Q318 was linked to the 19-year "Metonic" cycle and I put the case that not only could it be used to work out the moon's position in the zodiac in the Babylonian calendar but also that it approximated to the zodiac sign of the moon according to the Hebrew calendar today (retrojecting the position of the zodiac to 2,000 years ago).

CHAPTER 2

4QBrontologion: Transmission, Origins and Significance

2.1 Introduction

There are no other brontologia in the Dead Sea Scrolls, nor are any other thunder omen texts attested in Aramaic from this time period. Hence, in terms of its language and provenience *4QBrontologion* is unique, although its content and archaic literary style is similar to Akkadian and Babylonian omen texts and to Byzantine sources in Greek. The outstanding questions surrounding 4Q318 are whether its origins are Mesopotamian or Hellenistic. It is the only known West Semitic link between the Byzantine Greek brontologia (and selenodromia or zodiac calendars) and parallel Mesopotamian material.

The brontologion is written in the standard Mesopotamian omen style of beginning with a conditional clause about the natural world followed by its interpretation in the earthly environment, a formula known as an protasis-apodosis, or, "If X . . . . then Y."[1] There are no extant Hellenistic elements (such as the mention of Eudoxus as an archaic authority), nor are there any Mesopotamian place names or names of kings, if any existed. The only proper noun is the reference to Arabs, an ethnic group name which crosses all linguistic boundaries in ancient Near East and Greek texts,[2] and as discussed in the previous chapter are also ruled by Taurus in Manilius's *Astronomica*. The late medieval Byzantine copies or imitations, in Greek, replicate the formulaic construction in the Qumran text.

This chapter examines the cultural and historical background to *4QBrontologion* (4Q318 column viii, lines 6b–9) on its own and as a composite divination text with *4Q Zodiac Calendar*. The study analyzes a wider range Byzantine texts written in Greek that contain variations of zodiac calendars and brontologia. These sections provide a broader analysis of the analogous late secondary sources in reference to the Qumran brontologion with the zodiac calendar than has hitherto been presented in earlier scholarship on this text.

1 Rochberg, " 'If P, then Q': Form and Reasoning in Babylonian Divination," reproduced in *In the Path of the Moon*, 399–410.

2 Bosworth, s.v. "Arab." *Encyclopedia Iranica*. II. 2. 201–203.

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Having traced the structure and possible technical function of *4QZodiac Calendar* to its origins in the Mesopotamian micro-zodiac in Chapter 1, the study examines earlier Mesopotamian omen texts related to the themes of thunder and the moon, in order to shed light on the background of *4QBrontologion*. Other texts from Qumran that are sympathetic to *4QZodiac Calendar* are included in this chapter. Finally, the issue of divination in Judea among the wider Judean society and the Qumran community in relation to *4QZodiac Calendar and Brontologion* will be weighed up in terms of ancient texts examined here and in Chapter 1.

2.1.1 *Background Scholarship*

Previous scholarship on *4QBrontologion* is not very extensive and has mainly focused one of the main issues that immediately concerned Milik,[3] namely the identification of its cultural influences. The Byzantine text that Milik briefly compared with the Qumran brontologion, *Geoponica* 1.10, is discussed in depth further on in this section since it bears the most similar textual alignments with *4QBrontologion*. As has been noticed by all previous scholars after Milik: Albani, Pingree, and Wise, the text of *4QBrontologion* is very similar to several late Byzantine thunder omens written in Greek.[4] Wise listed numerous medieval brontologia with similar wording to *4QBrontologion*.[5] Albani noted further the existence of a different kind of brontologion in the canonical Assyrian omen catalogue *Enūma Anu Enlil*.[6]

Pingree highlighted an important text, a medieval Greek zodiac calendar and brontologion from the national library in Paris (Suppl. gr. 1192),[7] and juxtaposed passages from *4QBrontologion* to show the points of inter-textual interest.[8] Wise and Albani also observed the similarities between the structure and content of the Paris text and the Aramaic thunder omen text.[9] The Paris

3 Milik, *Ten Years of Discovery*, 42.

4 Albani, "Zodiakos," 14–19; Pingree, "Astronomical Aspects," DJD 36, 271–272.

5 Wise, *Thunder in Gemini*, 23–33, nn. 24, 29, 31, 36–37, 46–50, 58, 63, 66, 67, 69–71, 75, 77, 260. (28, n. 46): a list of pericope in various texts listing the destruction of the king or his court, 29 n. 50; Albani, "Zodiakos," 14–19.

6 Albani, "Zodiakos," 14 (B. Meissner, *Babylonien and Assyrien*, vol. 2 (Heidelberg: C. Winter, 1925), 285; Armin Lange, "The Essene Position on Magic and Divination," *Legal Texts and Legal Issues* (ed. M. Bernstein et al.; STDJ 23; Leiden: Brill, 1997), 390–391 n. 52.

7 P. Boudreaux, ed. *Catalogus codicum astrologorum graecorum* [afterwards abbrev. *CCAG*], vol. 8.3 (Brussels: Lamertin, 1912), fols. 42v–46, pp. 193–197.

8 Pingree, "Astronomical Aspects," DJD 36, 272.

9 Albani, "Zodiakos," 17 nn. 44, 45; Wise, *Thunder in Gemini*, 27 nn. 36, 39, 31 n. 63, 33 n. 69, 35 n. 78, 43 n. 97.

brontologion is reviewed in detail with its accompanying zodiac calendar in the next section.

Pingree argued that *4QBrontologion* was either a version of an Akkadian omen text, or it was related to a Greek descendant of an Akkadian omen collection.[10] Since there are no comparative Greek brontologia in any extant primary source from the time period that 4Q318 was composed or copied, it is not known by which route this genre entered the Byzantine world. Pingree's theory is used as a structural framework for this central question throughout this chapter. Although Wise did not pay enough attention to the possible influence of ancient Near East thunder omens on *4QBrontologion*,[11] his analysis remains the most in-depth etymological study.[12] His research also contains the most detailed commentary on possible interpretations of the meaning of the text. While identifying *4QBrontologion* as virtually identical to numerous late antique Byzantine brontologia, Wise postulated that the text could be reinterpreted by its user to describe contemporary events.[13] He suggested that the period of the original composition of 4Q318 might have reflected a time when there was a Jewish ruler. This was possibly attested by the "clue" מלכא (4Q318 col. viii line 7), "the king," which could refer to one of the Hasmonean kings, Herod the Great, or to the later Herodian dynasty.[14] Wise also contemplated the idea that the Qumran brontologion was of a type that could have been used to forecast the destruction of Jerusalem.[15] His conjectural theory (as he admits)[16] will be considered at points throughout this chapter.

2.1.2 *Paleographical Issues*

In this sub-section different scholarly readings of various words and phrases are discussed and my interpretation of the paleographical problems is presented. Scholars have disagreed about certain readings in *4QBrontologion* due to the poor state of the material remains and differing interpretations of the scribe's handwriting. Aside from the lacunae, the surviving text was well preserved when it was discovered; the writing is neat, accomplished and readable. Both sections of *4QBrontologion* and *4QZodiac Calendar* were written by the same hand. See Table 2.1.2 and discussion, below:

10 Pingree, "Astronomical Aspects," DJD 36, 272.

11 Lange, "The Essene position," 390–391 n. 51.

12 Wise, *Thunder in Gemini*, 21–34, 48–50. See *Paleographical issues* in the next sub-section.

13 Wise, *Thunder in Gemini*, 23–34.

14 Wise, *Thunder in Gemini*, 49–50.

15 Wise, *Thunder in Gemini*, 32–33, 32 n. 65.

16 Wise, *Thunder in Gemini*, 49.

TABLE 2.1.2 *4QBrontologion 4Q318 column viii lines 6b–9*

6	דכר[א] *vacat* [אם בתורא] ירעם מסבת על[
7	[ו]עֹמל למדינתא וחרבْ [בד]רת מלכא ובמדינת אב[
8	להוא ולערביא[ ]א כפן ולהוון בזזין אלן בא[לן] *vacat*
9	אם בתאומיא יْרעם דחלה וסרעْ מנכריא ומ[*vacat*

6. Aries. *Vacat* [If in Taurus] it thunders (there will be) *msbt*[17] against
7. [and] affliction for the province, and a sword [in the cou]rt of the king and in the province of Ab[
8. will be. And to the Arabs [ ], hunger, and they will plunder each oth[er *vac*]*at* *vacat* If in Gemini it thunders, (there will be) fear and sickness from the foreigners and from[

(Transliteration and translation by Greenfield and Sokoloff, DJD 36, 263–264 {modified})

4QBrontologion begins on 4Q318 col. viii line 6b, probably mid-way on the row after a wide *vacat* and the damage from a large lacuna in the column. (See Figures 1.2–1.6) The *vacat* falls immediately after the very end of *4QZodiac Calendar*, which consists of one word דכרא (The Ram, "Aries") next to the margin (not restored in Figure 1.1). The lacuna extends into rows 7 and 8, where the gaps in the leather are smaller. Line 9 survived the damage and bears a small tear towards the end of the row. The end of col viii is torn off resulting in an uneven ragged left-hand edge and the loss of text at the end of all the rows. About 1.2 cm of text is missing from lines 6 and 7, and lines 8 and 9 have lost about 1 cm of writing. Some proposed restorations of missing or damaged words and letters, which are the subject of contention, are now discussed.

The beginning of the brontologion at 4Q318 col. viii line 6b after the *vacat* can be reconstructed [אם בתורא]ירעם "[If in Taurus] it thunders…" on the basis that line 9 begins with the same formula for "Gemini," אם בתאומיא "If in the Twins…", which is in tact and preceded by a small *vacat* to denote the beginning of a new unit. According to Yardeni, there are medial and final forms of the *aleph, mem* and *nun,* and in the case of the *aleph*, "the distinction is not always strictly maintained."[18] This observation may be relevant to the disputed reading concerning the *aleph*, the penultimate letter on 4Q318 col. viii line 7,

17 The uncertain second letter is discussed above.

18 Yardeni, "Paleographical issues," DJD 36, 260.

]ובמדינת אב. It is unclear whether the *aleph* is medial and the space before it, after the *taw* is a little too small for a word space. Hence, it may be part of the word]ובמדינתאב, "and in the province of B"[. Or, if the *aleph* is initial and the space before it is a little too large for a letter space, it may begin a new word:]ובמדינת אב, "and in (the) province of Ab"[. Alternatively, if it comes at the end of the word as a final *aleph*, the *bet* may be part of a noun construct, ובמדינתא]ב, "and in the province of B"[, or, the *bet* may be translated as "in," thus, ובמדי־]נתא ב, "and in the province in"[.

According to Greenfield and Sokoloff, the *aleph* in 4Q318 col. viii line 7b is a final letter before a small word space and it belongs to, "and in the province" [ ]ובמדינתא, as one word, thereby giving "province" the definite article and making a noun phrase followed by the *bet*, thus,]במדינתא ב, "and in the province (of B)"[. The noun beginning with *bet* would then be the subject of להוא, "will be," on the next line (4Q318 col. viii line 8a).[19] The prefix of the *lamed* before the third person masculine, singular imperfect of the root הוה, "to be," here may be a feature of Qumran Aramaic.[20] However, since this linguistic feature in 4Q318 is present in many other texts there may be a review of this form as an indictor of Qumran Aramaic.[21] Greenfield and Sokoloff stated that 4Q318 is an example of "Standard Literary Aramaic,"[22] this classification, too, is the subject of scholarly discourse.[23]

Schattner-Rieser also favours the interpretation that there is a word space between the final two letters on this line.[24] Wise conjectures that the *aleph* begins a new word, possibly a place name beginning with *aleph* and *bet*,]אב interpreting ובמדינת in the construct state with the reference to a province that was relevant to Second Temple Judaism.[25] Equally, he suggested that it could be the beginning of an adjective, such as]אבדן, "destruction," thus, "city of destruction"; this would be in keeping with the tone of the Byzantine brontologia and would be congruent with a culture familiar with apocalyptic prophesies.[26]

19 Greenfield and Sokoloff, "318," DJD 36, 264.

20 S. Fassberg, "Salient Features of the Verbal System in the Aramaic Dead Sea Scrolls," in *Aramaica Qumranica*, 68.

21 S. Fassberg, "Salient Features," 67 n. 16.

22 Greenfield and Sokoloff, "318," DJD 36, 270.

23 S. Fassberg, "Salient Features," 67–68; H. Gzella," Dating the Aramaic Texts from Qumran: Possibilities and Limits," *RevQ* 93/24.1 (2009): 63–65.

24 Ursula Schattner-Rieser, *Textes Araméens de la Mer Morte* (LACA 5; Brussels: Éditions Safran, 2005), 126.

25 Wise, *Thunder in Gemini*, 29–30.

26 Wise, *Thunder in Gemini*, 30–32.

Like Wise, Beyer reads the *aleph* as belonging to the beginning of the last word on the line, possibly a toponym.[27]

7 .[ו]עֹמל למדינתא וחרבֿ [בד]רת מלכא ובמדינתא ב[

7. [and] affliction for the province, and a sword [in the cou]rt of the king and in the province, [

GREENFIELD AND SOKOLOFF, DJD 36, 263–4

7 .[ו]עֹמל למדינתא וחרֹ[ב בד]רת מֹלכא ובמדינת אב[ ]

7. [and] toil for the cities, and, destru[ction in]the royal [co]urt and the city of dest[ruction] (?) [...]

WISE, *Thunder in Gemini*, 19–20, 29–32

7 .[ו]עמל למדינתא וחרֹ[בן לד]רת מלכא ובמדינת אב[ל – שגיא]

7. Not den Provinzen und Zerstörung dem Hofe des Königs, und in der Provinz von Abil (?) wird [viel...]

BEYER, *Die aramäischen Texte*, 2:167–8

When one compares the handwriting elsewhere in the text, it would appear that the final *alephs* are evident in the case of the first למדינתא, "to the province" (4Q318 col. viii line 7a) and מלכא, "the king"(4Q318 col. viii line 7b). It is, therefore, hard to agree with Greenfield and Sokoloff that the *aleph* in:]ובמדינתא ב is final; thus, Wise and Beyer's transcriptions,[28]]ובמדינת אב should be favoured against Greenfield and Sokoloff's reading:]ובדינתא ב. Furthermore, there is definitely no space between the *aleph* and *bet* at the end of line 7, an observation that also supports Wise and Beyer's interpretation.

Yardeni notes that there is an unusual *tsade* which appears "perhaps once in the text."[29] She states that it is in the cursive form, which is rare in the Jewish script, and that it appears regularly in Nabatean writing. This may be the letter

27 Klaus Beyer, *Die aramäischen Texte vom Toten Meer,* vol. 2 (Göttingen: Vandenhoeck & Ruprecht, 2004), 167–168.

28 So Beyer, *Die aramäischen Texte*, ibid., for the end of the line. Wise suggested the province of the possible toponym was the tetrarchy of Abilene, אב[לין, (*Thunder in Gemini*, 30) or "city of destruction" אב[ל, 30–32.

29 Yardeni, "Palaeography," DJD 36, 263.

transcribed as a *samek*]מסבת על by Greenfield and Sokoloff,[30] and Wise[31] in the brontologion, 4Q318 viii 6. None of the scholars has transliterated מסבת as מצבת, indicated by Yardeni. Wise interprets מסבת with a *samek*, favouring the root סבב, "turn, surround"; he comments that the use of this verb occurs "in only a few of the Aramaic dialects, generally those written by Jews who also actively used Hebrew."[32] His choice of letter is influenced by the text of a late Byzantine brontologion with a similar structure to 4Q318 (the Paris text, Suppl. gr. 1191) but it is not certain, as he himself admits at the end of a three-and-a-half page discourse on this single word.[33] Beyer transcribes the questionable letter as a *shin* in the preliminary edition and as a *kaf* in the 2004 edition[34] (although, compare the very clear *kaf* דכרא ("Aries" or "The Ram") in col. viii line 1. This undisputed *kaf* does not resemble the letter in מסבת).

6 ...אם [בתורא] ירעם מסבת על]

6 ...[If in Taurus] it thunders (there will be) *msbt* against
GREENFIELD AND SOKOLOFF, DJD 36, 263–4

6 ...[אם בתורא] ירעם מסבת על[מא

6 ...[If] it thunders [on a day when the moon is in Taurus] (it signifies) [vain] changes in the wo[rld (?)...]
WISE, *Thunder in Gemini*, 19–20

6 ...[אם בתורא] ירעם מכבת על[ימיא ו]

6 ...[Wenn es im Zeichen des Stieres] donnert [werden] Schmerzen[der] Jünglinge[sein...]
BEYER, *Die aramaische Texte vom Totem Meer*, Bd 2 (2004): 167–8

30 Greenfield and Sokoloff, DJD 36, 263–264.
31 Wise, *Thunder in Gemini*, 19–20, 23–27.
32 Wise, *Thunder in Gemini*, 25.
33 Wise, *Thunder in Gemini*, 27.
34 Beyer, *Die aramäischen Texte*, Ergänzungsband, 1994, 128–129; Beyer, *Die aramäischen Texte*, 2: 167–168; cf: the refutation of *shin* by Greenfield and Sokoloff, "318," DJD 36, 273.

6 ...[אן בתורא] ירעם מסבת על[מ--]

> 6 ...[S'il] tonne [dans la (constellation du) Taureau] il y aura la prise du mo[nde...]
>
> SCHATTNER-RIESER, *Textes Araméens de la Mer Morte* (126–8)

Schattner-Rieser argues that the possible *samek* in מסבת does not resemble a *samek* in סרטנא (the clearest example is at 4Q318 vii 6) but after weighing up several options she also translates מסבת by relating it to the root סבב, as "surround, besieged," (so Wise, as cited above) or נסב "capture" in a construct form with "people" [--ם]על.[35] She further argues that אם may be אן as the exchange of the initial and medial *mem* and *nun* ("מ et נ") was not an exceptional phenomenon at Qumran, although she does not advance this case for the second אם (4Q318 col. viii line 9).[36]

Despite his own arguments, Wise showed that the Qumran brontologion does not contain any evidence that could unequivocally be related to particular historical events, people or places from the Hasmonean or Herodian eras.[37] The remainder of this section will demonstrate the popularity of omen literature in the late Byzantine world, particularly the Greek brontologia. There is a voluminous number of Greek thunder books dating from the medieval period which profess to be copies of archaic material. The next sub-section deals with one of the most important of the Byzantine texts in relation to *4QBrontologion*.

2.1.3 *Questions Raised by* Geoponica

4QBrontologion contains an eclectic mixture of standard forms of forecasts, and a formulaic literary structure that is recognisable in a wide variety of late Byzantine Greek prognosticatory texts. Many of these, but not all, are brontologia that contain predictions similar in content to those Mesopotamian omen texts which resemble the Qumran thunder book stylistically. The late Byzantine texts are often combined with zodiacal calendars, as shall be shown. In terms of their composite structure they bear a greater similarility to 4Q318 than to the Mesopotamian material. The 'Dodekatemoria scheme' and '*Kalendertexte*' considered in Chapter 1, which resemble *4QZodiac Calendar*, are not twinned with brontologia.

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35 Schattner-Rieser, *Textes Araméens*, 126–128 notes 165, 167.

36 Schattner-Rieser, *Textes Araméens*, 128.

37 Wise, *Thunder in Gemini*, 25–34, 49–50. As stated above, he considered "the king," מלכא (4Q318 viii 7) as possibly designating a Hasmonean ruler, but this noun occurs as standard in the Byzantine Greek and Akkadian omina.

A number of the late Byzantine Greek zodiacal calendars and brontologia, and a zodiacal hemerologia (calendars of favourable and unfavourable days) analysed in this section, are putative Greco-Roman omen texts. They are often assigned to pseudepigraphical authors: historical or legendary figures from Greece, Rome or Egypt. As with *4QBrontologion* and the Mesopotamian material, these omen texts are concerned mainly with the king and country, agriculture, commodity prices, and environmental predictions. The texts generally list the 12 zodiac signs that may be occupied by the moon, or the sun, with designated countries and inhabitants who may be affected by each of the signs. This information is usually attributed to an authority such as Eudoxus, or a class of experts, for example, the Egyptians, or Chaldeans. A variety of late Byzantine popular brontologia written in Greek, both with and without accompanying zodiac calendars, are examined here.

One of the closest parallel thunder books to *4QBrontologion* identified by Milik as a comparative text when he first mentioned the existence of the brontologion in the Dead Sea Scrolls[38] is a section of *Geoponica* (*Agricultural Pursuits*), (Bk 1, chapter 10), a tenth century compilation of reputedly ancient, agricultural, literary folklore and astronomy traditionally attributed to a seventh century author, Cassianus Bassus.[39] Albani and Wise also noted the significance of this text for 4Q318.[40] The origin and dating of *Geoponica*, is not known and the textual history of this early medieval treatise is complex. According to Andrew Dalby, this was a shorter compilation in Greek, now lost, that was translated into Pahlevi, and from thence into Arabic. Another lost Greek source dates to the fourth century and was translated into Syriac, and from thence into Armenian and Arabic.[41] The brontologion of *Geoponica* 1.10 is attributed to a "Zoroaster," an assignation that is not regarded as authentic.[42] Hunger and Pingree state that another entry, also ascribed to "Zoroaster," on

38 Milik, *Ten Years of Discovery*, 42.

39 Thomas Owen (trans.), *Geoponica*, 2 vols. (London: Spilsbury, 1805–6), 1. 10; 19–21; Critical edition: H. Beckh, *Geoponica: sive Cassiani Bassi Scholastici De Re Rustica Eclogae* (Leipzig: Biblioteca Teubneriana, 1895), 19 (Bk A 10: 1–4) (repr., Leipzig: Biblioteca Teubneriana, 1994); John A.C. Greppin, "The Armenian and the Greek Geoponica," *Byzantion* 57 (1987): 46–55; H.J. Rose, "The Folklore of the Geoponica," *Folklore* 44.1 (1933): 57–90.

40 Wise, *Thunder in Gemini*, 28 n. 46; Albani, "Zodiakos," 13–17.

41 A. Dalby, *Geoponika: Farmwork. A Modern Translation of the Roman and Byzantine Farming Handbook* (Totnes, Devon: Prospect Books, 2011), 9–10. I owe this reference to Jim Dingley.

42 Rose, "Folklore," 58, n. 2 states that "Zarathustra" was "reputedly the founder of the Magian religion, he was held in high esteem as a magician, and his name forged to many books of late date."

lunar motion, *Geoponica* 1.7, is derived from Pliny, *Natural History* 18.32.[43] It is, therefore, likely that *Geoponica* and possibly the "Zoroaster" material is a witness to some texts that were known in antiquity. This sub-section will explore that theory in order to reach a view as to whether *4QBrontologion* is related to an ancestor of *Geoponica* 1.10.

Parts of *Geoponica* are interested in astrology as applied to agricultural practices, and significantly, some of its texts encompass horticultural advice based on the position of the moon in the zodiac, whether waxing or waning, and its daily visibility.[44] *Geoponica* 1.10 does not have an accompanying zodiacal calendar (there are no accompanying calendar systems in any of the *Geoponica* texts). The brontologion in *Geoponica* 1.10 begins with the moon in Aries and its preamble instructs the reader to commence the calendrical system from the heliacal rising of the Dog-Star (Sirius). The fact that the *Geoponica* 1.10 brontologion begins with the moon in Aries could suggest that the thunder book has a Babylonian origin. If the brontologion had followed a calendar determined by the rising of Sirius in July—possibly the "Sothic cycle" of the Egyptian calendar[45]—its predictions would probably start from closer to the moon in Leo (so *Geoponica* 1.8, see later in this sub-section). The prologue on Sirius is most likely to be a gloss; notwithstanding this, there are some textual similarities between the *4QBrontologion* and *Geoponica* 1.10. 3–4. The closeness between the texts is in bold type in the extract, below:

> 1/You must take notice of the first thunder every year that happens after the rising of the Dog Star. It must therefore be observed in what division of the circle of the Zodiac the moon is, when the first thunder takes place.
>
> 2/ If it thunders when the moon is in Aries, it is a sign that some persons in the country will be under consternation, and that there will be solicitude and flight among the human race, but afterwards tranquillity.
>
> 3/ **If it thunders when the moon is in Taurus** ἐν ταήρῳ τῆς σελήνης οὔσης ἐὰν βροντήσῃ, it is a sign that the wheat and barley will be injured, and that there will be affliction from locusts but mirth **in the royal palace** ἐν δὲ βασιλιΧῇ, and to them in the east, vexation and **famine** λιμόν.

43 Hunger and Pingree, *Astral Sciences,* 48–50; discussed further in this section.

44 See *Geoponica*, Bk 5, ch. 46 in Owen, 1; 187; Rose, "Folklore," 64.

45 Cf. The "Sothic cycle" of 1460 years was connected coincidentally with the inundation of the Nile and the start of the agricultural year, R. Hannah, *Ancient Calendars* (London: Routledge, 2008), 42–43, 45; Neugebauer, *HAMA*, 560.

> 4/ **If it thunders when it is in Gemini**, it portends trouble and disease, and injury to the corn, and perdition to **the Arabs** Ἀράβων . . . . . .[46]

Of interest here are the references to the royal court βασιλιΧῇ, in Taurus and the Arabs Ἀράβων, in Gemini[47] noticeably because of the comparative "the court of the king," מלכא[בד]רת (4Q318 col. viii line 7), "and to the Arabs," ולערביא, under the entry for the moon in Taurus in (4Q318 viii 8).[48] Famine, λιμόν (*Geoponica* 1.10.3) can also be a synonym for starvation, cf. כפן *hunger* (4Q318 col. viii line 8); this noun is also under the entry for the moon in Taurus in both texts. In *Geoponica* 1.10, neither "the royal court," nor, "the Arabs" are mentioned again in the predictions for when the moon is in any other sign of the zodiac when thunder occurs.

Alternatively, against the hypothesis that there is some significant intertextuality is the fact that a royal court and famine are almost ubiquitous motifs for other signs of the zodiac in many other texts. Furthermore, the predictions for the respective royal courts in *4QBrontologion* and in *Geoponica* 1.10 are different. In favour of the interpretation that there is a connection between the texts is the close proximity of the Arabs in Taurus in 4Q318 viii 8, and the Arabs in Gemini in *Geoponica* 1.10.4. The adjacent position may signify that the copyist of *Geoponica* 1.10 may have read a source related to a *Vorlage* of *4QBrontologion*. As stated, there was also a tradition attested in Manilius that Taurus 'rules' the Arabs.[49]

Wise has shown that the "royal court" appears under Taurus in other brontologia;[50] he describes one text in the 12 volume catalogue of Byzantine Greek astrological writings, Catalogus Codicum Astrologorum Graecorum

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46 Owen, *Geoponica* 1.10, 19–20; Beckh, *Geoponica* Bk A 10:1–4, 19; Rose translates 1.10: 3: "If it thunders when the moon is in Taurus, there will be failure of cereal harvests, locusts and distress and famine in the east, but rejoicing in the imperial court," in "Folklore," 64; Dalby, *Geoponika*, 62–63.

47 Beckh, *Geoponica*. Bk A 10:3–4.

48 Cf. Suppl. gr. 1191, *CCAG*. 8:3, 193–194.

49 Manilius may be witness to a tradition of attributing Taurus to the character of "effeminate Arabs," [because Taurus is 'ruled' by Venus] *Astronomica*, 4.754, see Chapter 1.3.2. The description means that Manilius' zodiacal geography includes the people as well as their lands which are 'ruled' by the zodiac signs, that is, the natives take on the mythological features of the deities that are synonymous with the ruling planet of the sign concerned.

50 Wise, *Thunder in Gemini*, 29 n. 47, *CCAG* 7, 164, lines 10–11: "If it thunders while the moon is in Taurus . . . (it signifies) gifts in the royal court." [Cf. *Geoponica* 1. 10. 3, see above).

(CCAG), as "most like Taurus [in comparison with *4QBrontologion*]."[51] This observation, again, could show that the thunder omen tradition was popular at some point and contained similar motifs and references. The names of the Mesopotamian provinces and their inhabitants such as those of Elam or Akkad, do not appear in the omina of *Geoponica*, nor as shall be shown, is it attested in other Byzantine copies of brontologia. It is possible that these names disappeared by the time the omen tradition appeared in West Semitic sources. Since the remainder of *4QBrontologion* does not survive, it is not known what other nations were named in the Qumran text.

Detailed observations of the heliacal rising of Sirius, the Dog-Star, around the beginning of the last trimester of July (cf. *Geoponica* 1.10.1) are copious in the late Babylonian Astronomical Diaries, which also include predictions for king, country, prices, weather and so on.[52] A related text to *Geoponica* 1.10: *Geoponica* 1.8, gives predictions for the zodiac sign occupied by the moon when Sirius rises (as opposed to when thunder occurs after the rising of Sirius); the text states that the heliacal rising of the Dog-Star takes place on July 20:[53]

> *Geoponica* 1.8 (preamble, and forecasts for the moon in Taurus and Gemini): "The rising of the dog-star is on the twentieth day of the month of July. You must then observe in what part the moon is when this rises.[54] If it rises, the moon being in Leo, there will be abundant crop of corn, and plenty of oil and wine, and all provisions will be cheap . . . if indeed in

51 Wise, *Thunder in Gemini*, 24 n. 24: He notes that textually *CCAG* 9:2 (ed. S. Weinstock; Brussels: Lamertin, 1953), 120–123 and 4Q318 "have in common, the king's court, war, famine and the mention of Arabs." He notes that Taurus contains a reference to the royal court: *CCAG* 9:2, 121. lines 5–6: "Taurus. If it thunders, it indicates a destruction of grain in the countryside of that region and joy with good cheer in the royal court."

52 F. Rochberg, *Heavenly Writing*, 124–125; A. Sachs posited a significant relationship between the heliacal rising of Sirius and the regulation of intercalation in the early development of the 19-year luni-solar cycle in the early 4th century B.C.E. See B.Z. Wacholder and D.B. Weisburg, "Visibility of the New Moon in Cuneiform and Rabbinic Sources," *HUCA* 42 (1971): 227–242 (at 240), citing A. Sachs, "Sirius Dates in Babylonian Astronomical Texts of the Seleucid Period," *JCS* 6.3 (1952): 105–114 (at 110).

53 Owen, *Geoponica* , 1.16–17 (full text, 16–18); Beckh, *Geoponica: sive Cassiani Bassi*, 15–17 (Bk A 8: 1–3). Rose, "Folklore," 64; E.S. McCartney, "The Classical Astral Weather Chart for Rustics and for Seaman," *Classical Weekly* 20:7 (29 November 1926), 51 n. 191, n. 190 (also citing *CCAG* 4, 154–155 as "an important and lengthy reference of similar character," for comparison); Dalby, *Geoponika*, 61.

54 Cf. Reiner, *Astral Magic*, 108: according to Reiner, the Greek astrological tradition interprets the Babylonian term *qaqqaru*, meaning "region," or "place" of the sky where the moon stands at that moment, as the sign of the zodiac. This place is considered auspicious or inauspicious.

> Taurus, there will be a great deal of rain, and hail, and blight, and divine wrath; if in Gemini, there will be plenty of corn, and of wine, and of every fruit, and the removal of tyrant, and destruction to the human race, and movement of armies . . ."

The extreme mixed prognostications, both auspicious and baleful, for Gemini may indicate that this text was corrupt. Bouché Leclercq stated that "Sirius est un intrus dans l'astrologie grecque," imported from Egypt.[55] The heliacal rising of Sirius on 20 July in *Geoponica* 1.8 is equivalent to the Egyptian date of the rising of the star on 25 Epiphi (1 Epiphi coincided with June 25, close to the summer solstice).[56] In this text, the order of the zodiac signs, beginning with the moon in Leo, follows the rising of the Sirius. This is a more realistic zodiacal position for the lunar conjunction (on July 20, when the sun may be entering Leo), or first crescent, than Aries, witnessed in *Geoponica* 1.10. Primary source interest in the astronomical position of the new moon at the rising of Sirius is attested in a series of mid-third century B.C.E. Greek ostraca in the Bodleian Library, University of Oxford. They describe a 40-year period of new moons in Epiphi preceding the rising of Sirius (then 24 Epiphi: July 18).[57]

Another text, *Geoponica* 1.12, contains weather predictions and political events, and so on, for 12 years, based on the position of Jupiter through each sign of the zodiac (thereby allowing one schematic year for Jupiter to traverse each zodiac sign).[58] All these entries in the collection would indicate that the structure of *4QBrontologion* was associated with an astronomical omen tradition that was transmitted in the West.

Finally, *Geoponica* 1.7, has textual similarities with other lunar calendrical scrolls from Qumran and part of the Astronomical Book of Enoch. The text outlines a lunar table stating when the moon is under the earth, that is, beneath the horizon and not visible[59] for agricultural purposes "from the new moon,

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55 Bouché-Leclercq, *L'astrologie grecque*, 367.

56 Wachsmuth, ed., *Ioanni Laurentii Lydi Liber de Ostentis . . . et Calendaria Graeca Omnia* (Leipzig: Teubner, 1863), 190.

57 *O.Bodl. 2176*. Neugebauer, *HAMA*, 946.

58 Owen, *Geoponica* 1:12, vol. 1: 22–30 Beckh, *Geoponica* Bk A 12 1–40, 21–28. See also *CCAG* 2: 144–152; 5: 172–179; 8. 3: 189–190 cited by E.S. McCartney, "The Classical Astral Weather Chart for Rustics and for Seamen," *The Classical Weekly,* 20.6 (15 November 1926), 43–49, 47n: weather indications when the planets are dominant in any of the 12 signs of the zodiac in *CCAG* 4: 83–87, and weather predictions according to the moon in any of the signs of the zodiac during June or July, in *CCAG* 7: 183–187; Dalby, *Geoponika*, 64–67.

59 Owen, *Geoponica* 1:6–7, 12–15; Beckh, *Geoponica* Bk A 6: 1–4, 11; Pliny, *Natural History* 18. 75 (32) (Rackham, LCL, v.5); Hunger and Pingree, *Astral Sciences*, 48–50; Dalby, *Geoponika*, 59–60.

to the 30th day."[60] It states, in a highly corrupted form, the length of time that the moon is in the sky, day by day, from half an hour in the night at first crescent, and half an hour in the day increasing its presence proportionately in time as it waxes each day, and the proportional amount of time it is visible in the day and the night, when it is waning, day by day. As stated, Hunger and Pingree suggested that *Geoponica* 1.7 is derived from Pliny's *Natural History*. 18.32[61] (as does the early 19th century translator, Thomas Owen).[62] However, the formulaic style of the lunar table[63] also bears an unmistakable similarity to mensual data in parts of the Ethiopic and the unabbreviated synchronistic calendar in the Aramaic Astronomical Books of Enoch, and the related Hebrew lunar calendrical text, 4QCryptA Lunisolar Calendar (4Q317),[64] lunar texts that are discussed in Chapter 3. These intriguing convergences suggest that similar scientific knowledge was culturally disseminated in the ancient Near East and preserved in the Mediterranean region from the first century.

In sum, the textual history of *Geoponica* collection is complicated; it appears to contain similarities with Mesopotamian and Byzantine material with various glosses, intrusions and corruptions. The overlap in some content between the predictions under Taurus and Gemini in the *Geoponica* 1.10 brontologion and *4QBrontologion* has been considered within the context of the *Geoponica* corpus. The analysis shows that the *Geoponica* may not be a invention but that it possibly contains some elements of lay science in a corrupted form from an earlier period. This does not make it invalid as a witness *per se*, but the texts have to be treated as secondary sources. The *Geoponica* brontologion did not have an accompanying zodiac calendar unlike the omen material now examined below.

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60 Owen suggests, with reference to Pliny, *Natural History*, 18. 32, that it is a reference to a synodic month consisting of 29 days, 12 hours, 44 minutes, 3 seconds, see Owen, *Geoponica* 1.7, 13 n.*p*.

61 Hunger and Pingree, *Astral Sciences*, 48. They state that the scheme is "clearly a Roman invention based on the previous crude adaptation of the Babylonian linear zigzag."

62 Owen, *Geoponica* 1.7, 13 n.*p*.

63 See Owen, *Geoponica* 1.7, 12–15 (Owen notes that there are numerous corruptions); Beckh, *Geoponica* Bk A 7: 1–31, 11–15.

64 See *1 En.* 78: 6–8: Nickelsburg and VanderKam, *1 Enoch*, 108; *4QAstronomical Bnoch*[b] (4Q209) frags: Tigchelaar and García Martínez, DJD 36, 138–139, 142–146; *4QAstronomical Bnoch*[c] (4Q210) frag. 1 col. iii lines 3–9: Milik, *BE*, 292–293, pl. 30; and 4Q317 frags 1+ 1a col. ii: M. Abegg, "4Q317 (4QCryptA Lunisolar Calendar)" in *DSSR 4: Calendrical and Sapiential Texts* (ed. D.W. Parry and E. Tov; Leiden: Brill, 2004), 58–72; DJD 28, pls. 52–58.

2.2 Byzantine Brontologia with Calendars

This section explores late Byzantine zodiac calendars composited with brontologia and related omen texts. The abundance of very similar Byzantine Greek material, some of which has been discussed by other scholars, is here surveyed in relation to *4QZodiac Calendar and Brontologion*. This selection of zodiacal Byzantine calendars and brontologia exemplifies the sense of the wide diversity and popularity of the genre in the late medieval period in the Byzantine world. The striking profusion of anachronistic zodiac calendars in the sixteenth century in Byzantine Greek with omen texts, and more rarely in Hebrew without the thunder omens from the same period (see Chapter 6), is in stark contrast to their solitary presence in at Qumran and apparent absence from the Mediterranean world in antiquity.

2.2.1 *The Structural Twin to 4Q318*

This sub-section will discuss the sixteenth century manuscript in the National Library of France in Paris, Suppl. gr. 1192, fols. 42v–46, which consists of a zodiac calendar (fols. 42v–44v) and brontologion (fols. 44v–46).[65] As stated in the previous section, without exception Albani, Wise, and Pingree identified 4Q318 as structurally almost identical to the Paris text, entitled: "Brontologion with the 12 signs of the zodiac," Βροντόσκοπιον τῶν δώδεκα Ζωδίων and "Selenodromion" [two words], Σελήνης δρόμον.[66] Its editor, P. Boudreaux, pointed out the similarity between this text and *Geoponica* 1.10.[67] It is closer to the Qumran text in its structure than the contemporaneous Hebrew versions discussed later.

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65 P. Boudreaux, "Paris S.Gr 1191," *CCAG* 8.3. fols. 42v–46, pp. 193–197 (hereafter, the Paris text), and notes, 87–88, op. cit; Pingree, "Astronomical Aspects," DJD 36, 271–272.

66 Boudreaux, 193; catalogued in Henri Omont, ed., *Catalogue des manuscrits grecs, latins, français et espagnols et des portulans recueillis par feu Emmanuel Miller* (Paris: E. Leroux, 1897), 51, 52; Albani, "Zodiakos," 17–20; M.O. Wise, *Thunder in Gemini*, 27 n. 36, 35 n. 78 [n. 78 with error: "Paris S. gr. 1191 *CCAG* 7.193–197 instead of *CCAG* 8.3, 193–197]; Pingree, DJD 36, 271–272 (271 n. 35). Pingree aligned and translated the brontologion in 4Q318 with a rearranged extract from Suppl. gr. 1191 44–46v to demonstrate the close textual overlaps, DJD 36, 272. Cf. Wise, *Thunder in Gemini*, 33 n. 69, "If it thunders in Taurus, as the Egyptians write . . . it signifies famine in Egypt and Arabia and among the barbarians." Pingree also drew attention to two other similar Greek astrological texts, in DJD 36, 271: Ambrosius A 56 sup., f. 1, in A. Martini and D. Bassi, *CCAG* 3, 4, 25–29, copied in 1540 and attributed to Leo the Wise (ninth century); and MS 210, fols. 6–8, in the Library of the Historical Society of Athens, in A. Delatte, *CCAG* 10 (1924), 46, 203–227, copied in the eighteenth century.

67 P. Boudreaux, "Paris S.Gr 1191," *CCAG* 8.3, 93.

Like 4Q318, the Paris text begins with its zodiac calendar and is followed by the brontologion consisting of predictions in the order of the moon through the zodiac signs. Both its calendar and thunder text begin when the moon is in Aries. There are 366 days in its year, the number of days in a solar, leap, year. The brontologion is incomplete; it is missing the prognostications for thunder in Aquarius and Pisces. According to Pingree, the Paris omen text may be descended from an Akkadian original, or it may be a version of a Hellenistic adaptation from a Mesopotamian source.[68]

Each paragraph of the lunar zodiac text commences with the month names (of the Roman calendar in Greek) (fol. 42) and is directly followed by the brontologion. The selenodromion has the same formulaic style of tabulation as the 4Q318 zodiac calendar, a difference being the schematic pattern of the two-day and three-day arrangement when the moon occupies each zodiac sign.[69] The month names begin the list of the numerical days of the month, followed by the name of each consecutive zodiac sign in which the moon is positioned on those dates (March: 1, 2, Aries, 3, 4, Taurus, and so on for each of the 12 months). The selenodromion, or zodiac calendar (fols. 42v–44) begins with the moon in Aries on March: days 1 and 2, the first month in the calendrical sequence: (see Table 2.2.1 for the full 12 months):

> Μηνὶ Μαρτίῳ ά β′ Κριός, γ′ δ′ Ταῦρος, έ Φ′ ζ′ Δίδυμος, η θ′ ί Καρκίνος, ιά ιβ′ Λέων, ιγ′ ιδ′ ιέ Παρθένος, ιΦ′ ιζ′ Ζυγός, ιή ιθ′ κ′ Σκορπίος, Κά κβ′ Τοξότης, κγ′ κδ′ κέ Αἰγόκερως, κΦ′ κζ′ Ὑδροχόος, κή κθ′ λ′ λά Ἰχθής
>
> Month: March: 1, 2, Aries; 3, 4, Taurus; 5, 6, 7, Gemini; 8, 9, 10, Cancer; 11, 12, Leo; 13, 14, 15, Virgo; 16, 17, Libra; 18, 19, 20, Scorpio; 21, 22, Sagittarius; 23, 24, 25, Capricorn; 26, 27, Aquarius; 28, 29, 30, 31, Pisces.

Pingree called the arrangement of the Paris text and the moon on day 31, "astronomically worthless," and he added this was not the case with the Qumran zodiac calendar.[70] *4QZodiac Calendar* prefixes each day with the formula ב, "on the," for the first day of the moon's entry into a zodiac sign, followed by, וב, "and on the," for the second, or the second and third days (exceptions in 4Q318 col.

68 Pingree, "Astronomical Aspects," DJD 36, 272.

69 The sign order for the number of days spent by the moon in each zodiac sign each month commencing with Aries in March is 2-2-3-3; 2-3-2-3; 2-3-2-3 or 4 (Feb: 2) [30 or 31 days; Feb: 29 days], see Table 2.3.1 for the arrangement in the Paris text for the full 12 months. Cf. the days spent by the moon in each sign every month in 4Q318 are: 2-2-3; 2-2-3; 2-2-3; 2-2-3; 2 [30 days], Boudreaux, *CCAG* 8.3, 193–195.

70 Pingree, "Astronomical Aspects," DJD 36, 271.

viii lines 2, 4). This aspect of the formula is absent from the Paris lunar zodiacal table. The months in the Paris selenodromion of March, May, July, August, October and December have 31 days, the rest have 30 days, except February, which has 29 days, totalling a 366-day, leap, solar year. It is intriguing that this combination-genre (the zodiac calendar with a parallel thunder omen text) appeared in the wider Eastern Orthodox Church milieu, some 1,500 years after 4Q318 was copied no other structurally similar texts are attested between these two periods.

Given the later context of such a similar text, for argument's sake we should consider whether there are any identifiable Roman influences in the Byzantine Greek versions. Of note, the beginning of the year in the Paris text is in March, as it is in 4Q318 and the Babylonian texts, whereas the Roman year began on January 1. The date of the Roman New Year was January 1 apparently before Julius Caesar's reform of the calendar, in 45/46 B.C.E., in the *ultimus annus confusionis*.[71] According to historians, in antiquity this recorded year-beginning dated from the late eight century B.C.E. from the reign of Numa Pomilius (753–673 B.C.E.)—the king subsequent to the legendary Romulus, founder of Rome—who reformed the calendar from its archaic beginning in March.[72]

Ovid (fl. late first century B.C.E. to early first century) also stated that there was a 10-month year in prehistoric Rome that began in March, as evidenced by the surviving month names; these became disconnected from the months when Numa added January and February into the calendar to create a 12-month year: December means the tenth month.[73] He noted that the 10-month calendar precluded an alignment between the months and the signs of the zodiac, due to the lack of astronomical knowledge.[74]

Plutarch (fl. late first to second century C.E.) tells us that prior to Numa's reforms, an early Roman 360-day calendar with unequal month-lengths began in March and that it was neither lunar nor solar.[75] He records that Numa introduced an early version of a 12-month luni-solar calendar in which there was an intercalary month every two years of 22 days' length to compensate for

71 Samuels, *Greek and Roman Chronology*, 164–165; Blackburn and Holford-Strevens, *Oxford Companion to the Year*, 671; Hannah, *Greek and Roman Calendars*, 117 (the quotation comes form Macrobius, *Saturnalia* 1.14.3); D. Feeney, *Caesar's Calendar* (Berkeley: University of California Press, 2007), 196.

72 Plutarch, *Parallel Lives: Romulus*, 18.1–4; *Numa*, 19.1–2 (Perrin, LCL).

73 Ovid, *Fasti* 3.99–166 (Frazer, LCL) (see also Chapter 5). B. Blackburn and L. Holford-Strevens, *The Oxford Companion to the Year* (Oxford: OUP), 784, place this date on March 1; Hannah, *Greek and Roman Calendars*, 99–102.

74 Ovid, *Fasti*. 3.105–110 (Frazer, LCL).

75 Samuel, *Greek and Roman Chronology*, 165, 167–168; Plutarch, *Parallel Lives: Numa* 18.1–4, 19.1–2 (Perrin, LCL).

the excess 11 days between the length of the 354 day year and the solar year of 365 days. He also supported his claim by pointing out that Numa's month-names are evidence of an original 10-month year counting March as the first month, adding that Quintilis, means the fifth, and Sextilis the sixth, and so on.[76] However, some modern historians argue whether there is actual historical evidence that the archaic Roman year began in March; Sacha Stern contends that the theory "has been much discussed but remains speculative."[77]

If it is the case that the legend of the 10-month calendar beginning in March is etiological to account for the number-based nomenclatures of the months, a convincing explanation remains, intriguingly, outstanding. The puzzle of the Paris text's selenodromion commencing with the first day of the moon in March may be explained as a co-ordination between the months and the order of the luni-solar signs of the zodiac, beginning in Aries; but there is no primary source evidence that the Romans used this system. The date of the spring equinox in the reformed Egyptian calendar that was brought into line with the Roman calendar, the Alexandrian calendar, is c. March 22,[78] but the beginning of the months in the Alexandrian and Julian calendars were not aligned to the equinoxes or solstices.

Furthermore, unlike *4QZodiac Calendar*, the months in the Paris text are not 30 days long, nor does it have a Roman format: the Julian calendar did not have a 29 February, but an additional 24th day, the *bissextus* (a repeated sixth day before the Kalends of March).[79] The repeated 24th February in a leap year

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76 Plutarch, *Numa* 18.3–19.2 (Perrin, LCL). He does not use the month-name of August: in 8 B.C.E. the sixth month, *sextilis* was named Αὐγουστῳ following the correction of Julius Caesar's calendar, see Blackburn and Holford-Strevens, *Oxford Companion to the Year*, 670–671; Hannah, *Greek and Roman Calendars*, 112–114, 116–122; Samuel, *Greek and Roman Chronology*, 154–158, 155 n. 6.

77 Stern, *Calendars in Antiquity*, 208 n. 138; J. Rüpke, *The Roman Calendar from Numa to Constantine: Time, History and the Fasti* (Chichester: Wiley-Blackwell, 2011), 133, n. 131, citing Tacitus *Ann.* 13.10.1 (that the January 1st New Year was instituted by Nero) (Jackson, LCL), but there was also a flexible New Year's Day in which the calendar was used locally to honour Augustus, in Suetonius, *Aug.* 59 (Rolfe, LCL).

78 Neugebauer, *HAMA*, 929. (The Alexandrian calendar came into effect on 29 August, 23 B.C.E., see E.G. Richards, *Mapping Time* (Oxford: OUP), 156–157. Lehoux notes the literary evidence that the Kalends, Nones and Ides once very roughly coincided with the first appearance of the half-moon and full moon in idem, *Astronomy, Weather and Calendars in the Ancient World*, 47, ref: Macrobius (fifth century C.E.), *Sat* 1.15.9–12, Varro (fl. first century B.C.E.), *On the Latin Language* vi.27 (Kent, LCL). A similar system may be attested in the classical Greek calendar described by Hesiod, see Hannah, *Greek and Roman Calendars*, 43–44.

79 Blackburn and Holford-Strevens, *Oxford Companion to the Year*, 671, 678–680; Samuel, *Greek and Roman Chronology*, 156, 160–161, 182.

and the Roman calendar system of counting days from the Kalends, Nones and Ides was known in the sixteenth century, when this text was copied.[80] There is, therefore, little basis with which to conjecture that the creation of the Paris text was modelled on a theoretical, mythological ancient Greek or Roman lunar calendar[81] from whence it was transmitted to Byzantium in later antiquity and copied in the late Middle Ages. Their historical origins, like 4Q318, were Babylonian and it is evident that there was some harmonisation with the days of the month in the known Julian calendar but, as discussed, there is no internal evidence to suggest a Greco-Roman provenance.

Table 2.2.1 presents the Paris selenodromion organized graphically in the same tabular form as Table 1.1.3, for comparative purposes. The formulaic arrangement of the signs is replicated with its textual mistakes. The correct zodiac signs have been placed in parentheses next to the original erroneous ones. The corrections in the Paris text are based on the arrangement of the moon in the zodiac signs in the schematic lunar zodiac for March, April, July, September and November in the text.[82] There is shading for the days when the moon has been assigned three days in one zodiac sign.

In short, one must conclude that the Paris selenodromion is too corrupted to be a direct copy of a hypothetical Babylonian text that was related to 4Q318 and there is no internal evidence that it was transmitted from a contemporaneous Aramaic relation of 4Q318 into Hellenistic Greek before reappearing in the Byzantine world. Pingree thought that the missing link was an Akkadian text such as Tablet 44 of *Enūma Anu Enlil* from which either this text and Aramaic versions were descended, or that the Aramaic version came from Hellenistic Greek descendants of the original Akkadian tablets. He felt that in the absence of the Akkadian version, "any suggestions are purely speculative." Later research has not shown that there is an Akkadian original, as Pingree had thought, and the problems of confirming the paths of transmission remain open.[83]

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80 Blackburn and Holford-Strevens, *Oxford Companion to the Year*, 678–680.

81 Possibly before lunar calendars fell into disuse in the fifth century B.C.E., see Lehoux, *Astronomy, Weather and Calendars*, 47 n. 50; Samuel, *Greek and Roman Chronology*, 166–168; Hannah, *Greek and Roman Calendars*, 42–45.

82 Boudreaux, ed., *CCAG* 8.3, 193–195.

83 The statement by Ben-Dov that Aramaic served as a vehicle for the transmission of Akkadian to the Hellenistic world, *Head of All Years*, 286–287, may be entirely logical; however, this study will explore the complex avenues involved in the interaction of scientific knowledge in Greek and Aramaic at Qumran and argue that this process is more complicated in the different cases of the Aramaic texts, *4QBrontologion* and *4QZodiac Calendar*, and the Aramaic Astronomical Book at Qumran.

TABLE 2.2.1 *Paris Suppl. gr. 1191 42v–44* (*selenodromion*)

	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb
1	♈	♉	♊	♋	♌	♍	♎	♏	♐	♑	♒	♓
2	♈	♉	♊	♋	♌	♍	♎	♏	♐	♑	♒	♓
3	♉	♊	♋	♌	♍	♎	♏	♐	♑	♒	♓	♈
4	♉	♊	♋	♌	♍	♎	♏	♐	♑	♒	♓	♈
5	♊	♋	(♌)♋	♍	♎	(♏)♎	♐	(♑)♐	♒	(♓) ♒	(♈)♓	(♉)♈
6	♊	♋	♌	♍	♎	♏	♐	♑	♒	♓	♈	♉
7	♊	♋	♌	♍	♎	♏	♐	♑	♒	♓	♈	♉
8	♋	♌	(♍)♎	♎	♏	(♐)♏	♑	♒	♓	♈	♉	♊
9	♋	♌	(♍)♎	♎	♏	♐	♑	♒	♓	♈	♉	♊
10	♋	♌	(♍)♎	♎	♏	♐	♑	♒	♓	♈	♉	♊
11	♌	♍	♎	♏	♐	♑	♒	♓	♈	♉	♊	♋
12	♌	♍	(♎)♏	♏	♐	♑	♒	♓	♈	♉	♊	♋
13	♍	♎	♏	♐	♑	♒	♓	♈	♉	♊	♋	♌
14	♍	♎	♏	♐	♑	♒	♓	♈	♉	♊	♋	♌
15	♍	♎	♏	♐	♑	♒	♓	♈	♉	♊	♋	♌
16	♎	♏	♐	♑	♒	♓	♈	♉	♊	♋	♌	♍
17	♎	♏	♐	♑	♒	♓	♈	♉	♊	♋	♌	♍
18	♏	♐	♑	♒	♓	♈	♉	♊	♋	♌	♍	♎
19	♏	♐	♑	♒	♓	♈	♉	♊	♋	♌	♍	♎
20	♏	♐	♑	♒	♓	♈	♉	♊	♋	♌	♍	♎
21	♐	♑	♒	♓	♈	♉	♊	♋	♌	♍	♎	♏
22	♐	♑	♒	♓	♈	♉	♊	♋	♌	♍	♎	♏
23	♑	♒	♓	♈	♉	♊	♋	♌	♍	♎	♏	♐
24	♑	♒	♓	♈	♉	♊	♋	♌	♍	♎	♏	♐
25	♑	♒	♓	♈	(♉)♊	♊	♋	♌	♍	♎	♏	(♐)♑
26	♒	♓	♈	♉	♊	♋	♌	♍	♎	♏	♐	♑
27	♒	♓	♈	♉	♊	♋	♌	♍	♎	♏	♐	♑
28	♓	♈	(♉)♊	♊	♋	♌	♍	♎	♏	♐	♑	♒
29	♓	♈	(♉)♊	♊	♋	♌	♍	♎	♏	♐	♑	♒
30	♓	♈	(♉)♊	♊	♋	♌	♍	♎	♏	♐	♑	
31	♓		(♉)♊		♋	♌		♎		♐	♑	

Key to Table 2.2.1: Aries ♈; Taurus ♉; Gemini ♊; Cancer ♋; Leo ♌; Virgo ♍; Libra ♎; Scorpio ♏; Sagittarius ♐; Capricorn ♑; Aquarius ♒; Pisces ♓

2.2.2 *An "Etruscan Brontoscopic Calendar"*

The next calendar and brontologion to be examined is among several kinds of thunder omen texts and other kinds of omens preserved in John Lydus' Greek Byzantine astrological compendium *De ostentis* ["On Celestial Signs"] (sixth century).[84] Lydus's Greek version of a putative Etruscan brontoscopic calendar ascribed to Tages, and ostensibly preserved in Latin by Nigidius Figulus[85] (who is attributed with casting Augustus' horoscope in 63 B.C.E.),[86] has been discussed by Elizabeth Rawson, and Jean Macintosh Turfa,[87] the latter, in depth.

The "Nigidius Figulus" text is a very long, non-zodiacal brontologion and hemerology that states the prognoses for thunder for every day of a 360-day year comprising twelve 30-day months. Rawson describes the calendar as Roman, without discussing its 360-day year-length (nor the probability that it is not solar). Turfa accepts that Figulus, a friend of Cicero, translated the "brontoscopic calendar" ΕΦΗΜΕΡΟΣ ΒΡΟΝΤΟΣΚΟΠΙΑ from Etruscan into Latin, and that Lydus translated the Greek version from the Latin text.[88]

As stated in the previous sub-section, Plutarch discussed an early, Roman 360-day year commencing in March. The calendar in this hemerology has two year-beginnings: the full moon on June 1 and the new moon on July 1 (see below). The first divination from thunder begins at the full moon on June 1.[89] The date of July 1, may possibly align the Julian calendar with the start of the year in the Greek calendar which commenced with the first new

84 *Ioannis Laurentii Lydi Liber de Ostentis et Calendaria Graeca Omnia* (ed. C. Wachsmuth; Leipzig: Teubner, 1863; 2nd ed., 1897; abbrev: *De ost.* (1863) and *De ost.* (1897); M. Maas, *John Lydus and the Roman Past: Antiquarianism and Politics in the Age of Justinian* (London: Routledge, 1992), 105–113; *Index to the Three Works by Ioannes Lydus: New Critical Translation of De Mensibus, De Ostentis and De Magisratibus* (ed. A. Bandy et al.; Lewiston, NY: Edwin Mellen Press, 2012). (s.v. John Lydus in Bibliography).

85 Wachsmuth, *De ost.* 27–38 (1863); Maas, *Lydus,* 107; A. Piganiol, "Sur le calendrier brontoscopique de Nigidius Figulus," in *Studies in Roman Economic and Social History in Honour of Allan Charter Johnson* (ed. P.R. Coleman-Norton et al., Princeton, NJ: Princeton University Press, 1951), 79–87. I thank Jim Dingley for this reference.

86 Suetonius, *Aug.* 94.5 (Rolfe, LCL).

87 E. Rawson, *Intellectual Life in the Late Roman Republic* (Baltimore, MD: John Hopkins University Press, 1985), 310; J.M. Turfa, "The Etruscan Brontoscopic Calendar," in *The Religion of the Etruscans* (ed. N.T. de Grummond and E. Simon; Austin, TX: University of Texas Press, 2006), 173–190, Greek text and English translation: 182–190; J.M. Turfa, review of Giovanni Lido. *Sui segni celesti* (ed. I. Domenici; trans. Erika Maderna; Milan: Medusa, 2007), *Bryn Mawr Classical Review* 2008. 07.14. Cited 20 December 2010. http://bmcr.brynmawr.edu/2008/2008-07-14.html.

88 Turfa, "The Etruscan Brontoscopic Calendar," 174–175.

89 The first full moon in Cancer, Turfa, "Brontoscopic calendar," 190 n. 1 (see below).

moon after the summer solstice (in Hektombaion: June/July).[90] The calendar also has a new year when the new moon is in Cancer (see the brontologion and preamble, below).

The double calendar commencement: the full moon in June and the new moon in July, may be the result of redaction, or intrinsic to the text. According to Jones, in the fourth century B.C.E. there would be no contradiction in having two distinct year-beginnings, the solstice (the solar calendar for the parapegmata)[91] and the new moon after the solstice (the Greek lunar calendar).[92] The double beginnings of this brontologion are extracted below:

> ΜΗΝΙ ΙΟΥΝΙΩ
> Σελ·ά·ἐαν βροντήσῃ . . .[93]

> In the month of June: Full moon. 1. If in any way it should thunder, there will be an abundance of fruits, with the exception of barley; but dangerous diseases will be inflicted upon bodies.[94]

> ΙΟΥΛΙΟΣ
> ά· Ἐπὶ τῆς σεληνιακῆς νουμηνίας ἐὰν βροντήσῃ . . .[95]

> July 1. Upon the new moon, if in any way it should thunder, there shall be plenty, yet there shall be ruin of the flock.[96]

There are several possible interpretations for the hemerology to commence with either the first full moon in June, or the new moon in July (beginning with Cancer, see preamble below): a) the text was originally related to the late classical Greek calendars, which began at the first sighting of the new moon after the summer solstice, b) either June or July is a gloss, or, c) the user could begin the calendar either on the full moon in June, or the new moon in July, according to the occurrence of thunder.

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90 Bernard R. Goldstein and Alan C. Bowen "On Early Hellenistic Astronomy: Timocharis and the First Callippic Calendar," *Centaurus* 32 (1989): 272–293 (274); A. Jones, "Calendrica 1: New Callippic Dates," *ZPE* 129 (2000): 141–158 (157); R. Hannah, *Greek and Roman Calendars* (London: Duckworth, 2005), 43.

91 For parapegmata, § 5.4.1.

92 Jones, "New Callippic Dates," 37.

93 Wachsmuth, *De ost.* 57 (1863).

94 Translation: Turfa, "Brontoscopic calendar," 182.

95 Wachsmuth, *De ost.* 60 (1863).

96 Translation: Turfa, "Brontoscopic calendar," 183.

> Brontoscopic Calendar
> Arrangement according to the lunar month
> By the Roman Figulus
> From the sayings of Tages.
> Account translated word for word.
> Supposing that publicly, in all augural teaching, the ancients assumed the moon to be a reference point (for under this heading they classified both thunder and lightning signs), one likewise may correctly select the phase of the moon as a factor for reckoning, so that, beginning with Cancer καρκίνου, we shall make observations of thunder day by day, beginning with the first day of the lunar month, and following lunar months. From this [study] the Etruscans transmitted local observations with regard to the regions that are struck from the sky by thunder.[97]

It would appear that the last option may have been intended by the time the final form of the brontoscopic calendar was compiled because the ascribed author—ΠΩΜΑΙΟΝ ΦΙΓΟΥΛΟΝ ("the Roman Figulus" see extract above)—refers to the process of reckoning the correct phase of the moon. This opens the possibility that a lunar zodiac calendar had accompanied the text. There are signs of redaction: the two beginnings are worded differently and there are variant protases for different sections of the year. June, July and August, and September begin each day with: ἐὰν βροντήσῃ . . .; this differs for the daily protasis for October to May, which states, εἰ βροντήσῃ . . .[98] The variants may intimate that the entire quarter was copied or composed at a different stage. Turfa suggests that there may have been reasons for the different wording of the conditional "if" clause in the [presumed] original Etruscan.[99]

Based on Turfa's observations, it is possible that the prologue by "Figulus" and the hemerologies for June to September, therefore, were composed, or edited, at the same time. The calendar may have undergone further redaction when the zodiac was apparently removed. It is unlikely that the preamble was added after the hemerology was copied because one zodiac sign, Cancer, is mentioned, and it makes no sense to add in a single zodiac sign if there were no other signs in the hemerologies.

The prologue possibly intimates that the text's user could begin the hemerology from the date of the first thunder after the summer solstice, in Cancer,

97 Translation: Turfa, "Brontoscopic calendar," 182; from Wachsmuth, *De Ost.* 57 (1863).

98 Wachsmuth, *De ost.* (1863), 67–83.

99 Turfa, *Bryn Mawr* 2008–07–14. Turfa translates ἐαν βροντήσῃ . . . as, "if in any way it thunders" and, εἰ βροντήσῃ as "if it thunders."

starting the predictions either from the first crescent, or full moon, whichever the case. The phase of the moon in the lunar month closest to when the thunder occurred would possibly become the first day of the mantic year; the diviner could count the lunar months from phase to phase from that point. This 360-day zodiacal "brontoscopic calendar," differs from the intercalary 354-day, Greek luni-solar calendar by apparently having an option of beginning the calendar at the first full moon after the summer solstice, rather than only at the *noumenia* (new moon).

The implications for 4Q318 are interesting: the Qumran text is a 360-day lunar zodiac calendar and could conceivably also be a brontoscopic calendar. The two largest extant columns of *4QZodiac Calendar* begin on the full moon and new moon respectively: 4Q318 vii 1, "on the 13, and the 14th [Tevet], Cancer" (the full moon) and 4Q318 viii 1, beginning of Adar, "on the 1st and on the 2nd, Aries," the first crescent. It is an intriguing possibility that 4Q318 may also have used synodic months from full moon to full moon (days 14/15) as an alternative to counting a month from the first crescent to the next, depending on when the first thunder occurred after Nisan 1.

Moving on from the "Figulus" calendar to its brontoscopic elements, it would appear that the presumed hemerology bears some textual and structural similarities to Mesopotamian omina, for example, the non-zodiacal, Mesopotamian menological omen series, *iqqur îpuš*.[100] The last third of this Babylonian hemerology contains predictions on a range of celestial and meteorological phenomena, including solar and lunar eclipses, zodiacal light, thunder, fog, earthquake, mud and river floods, for example:

> Si, au mois de Nisan, le tonnerre gronde . . . . . .
> Si (c'est) au mois de Du'uzu, la moisson du pays sera prospère.[101]

The phase of the moon is not an element in any of the meteorological protases from this series. Some of this material is not directly transferable to parallel Greek texts because the Mesopotamian apodoses from the astrological omen texts include predictions for specific or symbolic cities, such as, Ur, Elam,

100 "He tore down and rebuilt," incipit translated by Rochberg, *Heavenly Writing*, 49, based on favourable and unfavourable months for constructing parts of a house; R. Labat, *Un calendrier babylonien des travaux des signes et des mois* (*séries iqqur îpuš*) (Paris: Librairie Honoré Champion, 1965).

101 Labat, *Un calendrier babylonien*, 72–73, text: 88:1, 5.

Subartu and so on, as discussed.[102] Other lunar apodoses in *iqqur îpuš* may have been too strange, such as an attack by dogs, which become enraged and kill all men and women during a lunar eclipse.[103]

In sum, the 360-day "Figulus" brontologion may be part of the wider variety of archaic literary style Greek omen texts based on the position of the moon in a zodiac sign. It specifies the lunar phase, which is unusual, and interestingly it appears to give its user a choice of lunar phases: new or full, with which to practice divination. It would appear from the text-critical evidence that this feature is possibly the result of redaction. The style of the alleged Etruscan brontologion reflects that of the Qumran omen text without its calendar. The next sub-section presents a study of further Byzantine selenodromia and brontologia analogous to 4Q318.

2.2.3 *More Byzantine Calendrical Omen Texts*

In addition to the brontologia of *Geoponica* 1.10, the Paris text, and the "Etruscan" 360-day hemerology, there are a large number of other late Byzantine copies of different kinds of zodiac calendars with thunder omen texts. This sub-section will discuss combined texts, many of which have been noted by other scholars, with more of an emphasis on the variety of their attached Greek calendars. Pingree highlighted other possibly related Greek omen texts in addition to the Paris text; these and others are now considered.[104]

One, Neopol. II.C.34, fols. 123v–125v states in the title that it is an "Interpretation of earthquakes through the 12 signs of the zodiac,"[105] although the protases in the text itself, in fact, refer to thunder, not earthquakes.[106] The "seismology" commences with the moon in Taurus for the month of April.

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102 R.D. Biggs, "The Babylonian Prophecies and the Astrological Traditions of Mesopotamia," *JCS* 37.1 (1985): 86–90; Labat, *Un calendrier babylonien*, 140–141, text: 67:13.

103 Labat, *Un calendrier babylonien,* 140–143, texts; 67–69:13. Cf. flesh-eating, mad-dogs are attested in later Syriac menologies for the omen of the observation of a rainbow in Ab, if the bow is seen in a western direction, see N. Sims-Williams, "Christian Sogdian Texts from the *Nachlass* of Olaf Hansen II: Fragments of Polemic and Prognostics," *BSOAS* 58 (1995): 288–302 (296 n. 39).

104 Pingree, DJD 36, "Astronomical aspects," 271–272 nn 38, 39. Those discussed here are: D. Bassi and A. Martini, Neopol. II.C.34, fols. 123v–125v, *CCAG* 4 (ed. D. Bassi et al.; Lamertin: Brussels, 1903), 170–172; F. Boll, "Tonitruale ignoti auctoris," *CCAG* 7 (ed. F. Boll; Lamertin: Brussels, 1908), 163–71, and *De Ost* 39–41 (1897), the "Fonteius" text, 88–92.

105 Bassi and Martini, Neopol. II.C.34, fols. 123v–125v, *CCAG* 4, 170. Ἡ Ἑρμηνεία τοῦ σεισμολογίου διά τὸν δώδεκα ζῳίων. This may be the "seismology" referred to by Pingree in DJD 36, "Astronomical Aspects," 272 n. 41, as well as n. 39.

106 Bassi and Martini, Neopol. II.C.34, fols. 123v–125v, *CCAG* 4, 170–172.

The copyist has omitted Capricorn (for December) and February is missing (there was no zodiac sign left for it). The format for the structure of each month of its selenodromion is as follows: April: day 1, Taurus; May: day 1, Gemini; June: day 1, Cancer; and so on. The second related text, the brontologion from an unknown source, "Tonitruale ignoti auctoris," comprises two units: a lunar and a solar zodiacal brontologion.[107] A solar zodiac thunder book would be easier to use than the lunar zodiac omen text because the sun remains in the same zodiac sign for a month; it can be used with the Julian or Alexandrian calendars. Both sections begin with the respective luminaries in Aries in April, followed by Taurus in May. The texts are completed in March when each heavenly body, the sun and the moon, is in Pisces. It is interesting that both sets of manuscripts in this "Tonitruale," the lunar and solar zodiacs, commence in April, rather than in March, which could suggest that the calendar is calibrated for an intercalary year. Pingree further notes other brontologia that have a more conventional March–Aries to February–Pisces structure.[108]

Lydus preserves a solar zodiacal brontologion beginning in January–Capricorn (not included in Pingree's list; he does not mention the solar zodiac brontologia).[109] This zodiacal thunder omen text (which appears to be a composite of two different texts)[110] continues: February–Aquarius; March–Pisces; April–Aries; May–Taurus; June–Gemini; July–Cancer; August–Leo; September–Virgo; October–Libra; November–Scorpio; and ends in December–Sagittarius. This is not quite in line with the Julian calendar: although the New Year's day of 1 January corresponds to the sun in Capricorn, the sun is also in that sign on 31 December, not Sagittarius. To effect a year commencing in

107 Boll, "Tonitruale," *CCAG* 7, 163–171, Boll compares this text to Neopol. II.C.34, *CCAG* 4, 170–172, and *Geoponica* I.10 (at *CCAG* 7, 163).

108 Pingree, DJD 36, 271 nn. 33–4 (*CCAG* 3:4, 25–29; *CCAG* 10:46, 203–227), the latter has a copyist's error in which March and April are aligned to Aries.

109 Wachsmuth, *De ost.* 23–26, 51–56 (1863). There is a reference to Media and Persia in May–Taurus.

110 The brontologion begins with the statement that the sun is in zodiac sign *x* in the month *y* for Capricorn–January; Aquarius–February; Pisces–March (*De ost* 23); Aries–April; Taurus–May (*De ost* 24); Libra–October; Scorpio–November (*De ost.* 26 (1863)); and another prescription, with the formula in reverse, beginning with the month name *y* followed by the sun in zodiac sign *x* for Month June–Gemini (*De ost* 24); Month July–Cancer; Month August–Leo; Month September–Virgo (*De ost* 25); Month December–Sagittarius (*De ost* 26).

Capricorn and concluding in Sagittarius could suggest that this calendar began at the winter solstice and that the last month ended before the solstice.[111]

Other lunar zodiac brontologia that start the calendar in January–Capricorn include Lydus' *De ostentis* 39–41, a "Brontoscopia of Fonteius the Roman";[112] Pingree describes it as "the most noteworthy" with reference 4Q318.[113] The thunder text begins in Capricorn and ends with Sagittarius.[114] It is said to preserve a version in CCAG 7, 226–230, entitled a "Brontologion of Hermes Trismegistus,"[115] a non-zodiacal text, which contains Egyptian month names within the apodosis, the predictions, for the month of July.[116] According P.M. Fraser, the brontologion attributed to Trismegistus was "clearly composed in Egypt; and apparently in the Ptolemaic period."[117] She does not evaluate the possibility that the text may have been deliberately archaised.

The chronologically eclectic brontologion of "David the Prophet" contains a lunarium that gives predictions based on the position of the moon in a calendar beginning in January and ending in December, without any zodiac signs.[118] It is followed by a lunar zodiacal brontologion on the same folio in which the

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111 Cf. Jones, "New Callippic Dates," 37. A winter solstice zodiac calendar is the reverse of the better—known summer solstice calendars.

112 *De ost.* (1897), 88–92 and *De ost.* (1863), 84–88; cf. F. Boll, *CCAG* 7 (Brussels, 1908), 226–230; A. Delatte, *CCAG* 3 (Brussels, 1901), 4, 25–29 fol. 2v; Albani, "Zodiakos," 15–16.

113 Pingree, DJD 36, 271.

114 For John Lydus, Fonteius may have been a source for Varro, see P.M. Fraser, *Ptolemaic Alexandria.* Vol. 2, *Notes* (Oxford: Clarendon, 1972), n. 508, 633–634. See also prognostications for dates for the moon through the signs of the zodiac commencing with Capricorn (not a brontologion), *De ost.* 17–20 (1863), 42–48.

115 This is a corpus of pseudepigraphal work apparently compiled by Egypt-based scribes originally dating from the second century B.C.E. to the first or second centuries C.E., see T. Barton, *Ancient Astrology* (London: Routledge, 1994), 25–26; Campion, *A History of Western Astrology*, 1.188; Tester, *A History of Western Astrology*, 21–24 nn. 21, 22 for bibliography. Cf. Tester cites Fragment 12 from the similar "Nechepso and Petosiris" corpus published by E. Reiss: "When Mercury is in Gemini at the time of the rising of Sirius, the rising (of the Nile flood) will be a proper one.," from idem, "Nechepsonis et Petosiridis fragmenta magica," in *Philologus*, Suppl. 6 (1892), 325–388.

116 Fraser, *Ptolemaic Alexandria.* Vol. 2, *Notes*, n. 508, 633.

117 Fraser, *Ptolemaic Alexandria.* Vol. 1, *Text*, 434–444. "If in the month of July it thunders or there is lightning in the day-time these indicate cosmic confusion . . . And about Phamenouth or Pharmouthi (they presage) death of oxen . . . and the appearance of a certain leader . . . If it happens by night the offspring of the barbarian Ethiopians will wage war on each other and (kings) of many races will come into conflict as far as the Babylonian race . . ." (Fraser's translation).

118 Boudreaux, ed., Paris gr. 2316 fols. 325v–326v, *CCAG* 8.3, 168–169.

signs are correlated to the Roman months and corresponding month ordinals. The text begins in March–Aries and completes its year in February–Pisces.[119] It was possibly composited by a copyist who saw the two elements as belonging together in the genre of the selenodromion and brontologion, although in this case the former is zodiacal and the latter, non-zodiacal.

In sum, it may be argued that there was a plurality and diversity of Greek zodiac calendars in the Byzantine era composed in the literary style of standard Mesopotamian omen texts. They may reflect a wide variety of different kinds of mantic calendars in antiquity that were transmitted, taking into account redactive processes. Alternatively, they could be part of a renaissance or revival of ideas that either saw a movement to replicate and preserve texts, or to reinvent them in an anachronistic style. If they are later secondary witnesses, or imitations, the implications for 4Q318 are that specific cultural features of brontologia in antiquity, such as the structure of the year, and the first zodiac sign occupied by the moon at New Year, whenever that was defined, rather than when thunder occurred *per se*, may have been regarded as mantically significant. It may also suggest that at some point the dual composition found in 4Q318 was possibly representative of a popular genre, in the literal meaning of the word, recovered long afterwards possibly via non-Western semitic sources and/or oral dissemination. The literary style of *4QBrontologion* follows that of the Mesopotamian omen texts as *4QZodiac Calendar* follows the zodiacal "Kalendertexte," discussed in the previous chapter.

2.2.4 *Parapegma with a Lost Brontologion*

We will now consider a brontologion that was composited by a medieval copyist with a calendar containing an approximate actual date from antiquity. This recent rediscovery is of some interest. Daryn Lehoux has republished a late medieval text known as the Oxford Parapegma consisting of a copy of a Greek parapegma and a cult calendar with actual dates with a part of a later appended zodiacal brontologion.[120] The thunder omen component had been excised by Stefan Weinstock in an earlier publication of the manuscript.[121] The complete

119 Boudreaux, ed., fols. 326v–327v, *CCAG* 8.3, 169–171.

120 Lehoux, *Astronomy, Weather, and Calendars*, 164, 392–399 (brontologion: 392, translation: 396).

121 S. Weinstock, ed., *CCAG* 9.1 (1951): 128–137. The brontologion is missing in this publication of the cult calendar. Furthermore, Weinstock did not mention the appended brontologion in his paper, "A New Greek Calendar and Festivals of the Sun," *JRS* 38 (1948): 37–42. The thunder text is therefore not referenced by David Pingree in the appendix to 4Q318 (DJD 36, 271–272), nor by Michael Wise in *Thunder in Gemini*, although the *JSR* article, ironically, happens to be cited by Wise, on p. 40 n. 90.

thirteenth century folio (C. Baroccianus 131, 423r,v)[122] contains a short zodiac brontologion for one month only,[123] making this an early version of this popular kind of text in Greek that continued until the end of Byzantium.

This thunder text, stating the prediction for when the moon is in Aquarius at the occurrence of thunder, appears at the end of February, when the sun is in Aquarius. The days of the month in the cult calendar with which it was copied are listed according to the newly reformed Julian calendar under Augustus[124] and it contains astronomical (and astrological), calendrical and cross-cultural information. It is not known when the brontologion was incorporated into the cult calendar.

The following is an extract from the parapegma with the brontologion (without reconstruction marks):

> **Risings and settings of the fixed stars.**
> **February: according to the Greeks, Peritios. According to the Egyptians, Mechir . . .**
>
> 26. The star on the knees rises, and there are contrary winds.
> Also the swallows appear. (This month [February]) is situated in the constellation of Aquarius. The night is 13 hours, and the day is 11.
>
> This month, when the moon is in Aquarius: if there is thunder (Τούτῳ τῳ μηνὶ σελήνης σὔσης έν Ὑδροχόῳ, ἐὰν γένωνται βρονταί), it signifies terrible wars on earth, confusion and diseases among men, ruin of grain and other crops, and the destruction of some lands. According to Eudoxos (Εὔδοζον), many storms. What is sown will be no good. Destruction of beasts. If there is an earthquake, it signifies death.[125]

122 The MS is dated 1250–1280 by Nigel G. Wilson, "A Byzantine Miscellany: MS Barocci 131 described," in *JDOB* 27 (1978): 157–179 (171–175, esp. 173); cf. H.O. Coxe, *Greek Manuscripts* (Oxford: Bodleian Library, Oxford, 1853, repr, with corrections, 1969) dates the collection to the fourteenth century. The new date in the Bodleian Library, University of Oxford, catalogue is c.1260–70, see MSS Barocci online catalogue, http://www.bodley.ox.ac.uk/dept/scwmss/wmss/online/medieval/barocci/barocci.html: My thanks to Colin Harris and Dr Bruce Barker-Benfield of the Bodleian Library, University of Oxford, for their invaluable assistance.

123 Lehoux, *Astronomy, Weather and Calendars*, 164, 392–399 (brontologion: 392, translation: 396).

124 See Blackburn and Holford-Strevens, *The Oxford Companion to the Year*, 671.

125 Lehoux, *Astronomy, Weather and Calendars,* 392, 396.

Until Lehoux's book appeared, the complete extant text, that is, with the inclusion of the brontologion, was virtually unknown. Although unaware of a related composition in the Dead Sea Scrolls, Lehoux pointedly notes Weinstock's decision to remove the brontologion from the parapegma, as follows:

> It is true that the material here is more or less what we should expect in a brontologia rather than what we should expect in a 'pure' parapegma. Nevertheless, parapegmata are flexible things, and it is clear that the material was seen as closely enough related to warrant inclusion in this text by a copyist. Far from ruining the urtext, the copyist has composed a new hybrid text of some interest. The inclusion of the Eudoxus reference is particularly noteworthy. Unfortunately, we only have this type of entry for the month of February.[126]

Weinstock dated the original parapegma to 15 C.E. based on the text's double date of the Egyptian New Year with August 20 in the Julian calendar.[127] The parapegma also lists the birthday of Augustus on September 23, the autumn equinox, which Weinstock stated locates the text to Asia Minor, where the birthday of Augustus was officially celebrated.[128] As Augustus died in 14 C.E., and there is no entry for Tiberius who succeeded him in the same year, it may be that the parapegma was written in advance of the year for which it was intended, that is, just prior to 14 C.E. or before the death of Augustus in that year (August, 14 C.E.). The Oxford brontologion (as I shall refer to the appended thunder omen) has similarities to the Paris brontologion: both mention Eudoxus as a source. The Paris omen text further names the Egyptians (Αἰγύπτιοι), Babylonians (Βαβυλώνιοι) and Chaldeans (Χαλδαῖοι) as sources (γράφουσι) in its predictions.[129]

The Oxford parapegma appears in the context of a solar star calendar and the solar zodiac, although, in contrast, its brontologion explicitly states that the protasis pertains to the month when the moon is in the sign of Aquarius.

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126 Lehoux, *Astronomy, Weather and Calendars*. 392–393 n. 195.

127 Lehoux, *Astronomy, Weather and Calendars*, 398 n. 204; Weinstock, "A New Greek Calendar," 39–40: The Egyptian New Year is determined by the rising of Sirius (Sothis) which takes which takes 1,460 years to return to the start of its calendrical cycle on Thoth 1, which is July 19 in the Julian calendar. As it was known that a Sothic cycle was completed in 139 C.E., it is possible to reckon the Julian year in the parapegma from the date that Thoth 1 falls in the calendar.

128 Weinstock, "A New Greek Calendar," 40.

129 Boudreaux, ed., "Paris S. gr. 1191", 95–97.

The explication of the moon in Aquarius may be a move by the copyist towards precision because the brontologion is included in a solar calendar. In other words, if the pericope had used the formula, "If it thunders in Aquarius," without reference to the moon (as with the formula in *4QBrontologion*) it would be assumed that the thunder omen could be applied exclusively to when the sun was in Aquarius since the parapegma section deals with the sun in Aquarius. It would appear that the copyist made an editorial insertion (adding the moon) and knew about lunar zodiacal brontologia. This editor was probably a scholar.

If the Oxford brontologion were meant to appear on a month-by-month basis when the sun changes zodiac signs, the protasis ("If it thunders when the moon is in zodiac sign *x*") would only apply if there were thunder around the conjunction of the sun and moon at the beginning or at the end of the month when the sun and moon were in the same sign. Another possibility is that if this editor had only the one pericope, a decision had to be made about where to place it (if the editor had other months, one may assume that he or she would have included them). Juxtaposing an omen for when the moon was in Aquarius with the sun in the same sign would be logical if the forecasts for the other signs were missing. If the editor only had the thunder text for when the moon was in Aquarius, the Oxford brontologion probably came from a different background, or time-period to the parapegma. The *Vorlage* of the Oxford brontologion probably did not belong to the parapegma in antiquity at all. Structurally, however, the brontologia in the Oxford Parapegma and in 4Q318 connect with their calendrical tables through the zodiac.

The question of when this tradition arose, and at what stage the brontologion was appended to the Oxford parapegma , and why, is intriguing. To repeat Lehoux, "the material was seen as closely enough related to warrant inclusion in this text by the copyist." Since the newly republished Oxford brontologion contains a reference to Eudoxus, it is possible that it is more closely related to a Byzantine Greek *Urtext* than to a Mesopotamian one. The overall relevance of the Byzantine Greek texts analogous to 4Q318 will now be evaluated.

2.2.5 *Discussion*

The question of whether *4QBrontologion* came from a common Hellenistic source with some of the medieval Greek brontologia and selenodromia will now be considered. By the omission of a reference to an authority to validate the prediction, the Qumran brontologion differs from the style of many of the medieval Greek copies of thunder omen texts studied in this section. It could be argued that *4QBrontologion* was redacted to erase Eudoxus or other ancient authorities such as the Greeks, Egyptians, Babylonians, or Chaldeans signified

in similar texts. However, such reasoning would be too speculative; it would be methodologically unsound to suggest that there may have been such references in the text that did not survive in Aramaic.

The brontologion in *Geoponica* 1.10, and the similar omen text of *Geoponica* 1.8, which is not a thunder text, do not allude to any arcane learned experts for legitimacy. They commence with an instruction to the user based on the heliacal rising of Sirius. It is not known if this form of divination, or literary genre, came from Babylonia or Egypt, or if it was a medieval anachronistic innovation. However, the textual similarities between *4QBrontologion* and *Geoponica* 1.10 suggest that the latter need not be dismissed as a late imitation. The last part of this section established that the *Vorlage* of the Oxford parapegma could possibly have the *terminus a quo* of c. 14 C.E., and its brontologion could have been added from that time up until the thirteenth century. It contains the Eudoxus motif, as do most of the other brontologia in the CCAG compilations, many of which were copied in the sixteenth century.

The similarity between *4QBrontologion* and the Byzantine copies of brontologia hinges on the fact that they all retained the archaic Mesopotamian literary style. The references to geographical names found in Babylonian astrological texts and omen texts—Ur, Akkad, Amurru, Elam, Subartu and Guti[130]—do not exist in the Qumran omen text or the Byzantine Greek omen texts, although known places do exist in the Byzantine texts and the references to a race of people associated with particular zodiac sign within an apodosis has been preserved in both *4QBrontologion* and the Byzantine equivalents. As 4Q318 is the earliest attested probable link between Babylonian scholarship and what may have been a popular form of divination and diverse literary presence in the Byzantine world, the next section investigates the relationship between *4QBrontologion* and related omens in the ancient Near East

2.3 Mesopotamian Science and Omen Literature

Having surveyed Byzantine Greek thunder omens, this section examines the Mesopotamian nexus with *4QBrontologion*. This study will now consider the connection of early thunder omens with the moon, the calendar and astrology in the ancient Near East.

According to Francesca Rochberg, predictions tend to be interchangeable between different omen series and it is not possible to discern which series

130 Rochberg, *Heavenly Writing*, 109; E. Weidner, "Astrologische Geographie im Alten Orient," *AfO* 20 (1963): 117–121.

borrowed from the other.[131] Guinan states that the same apodoses, such as the destruction of Akkad, are repeated with different protases.[132] (Some apodoses are not reflected in other Babylonian series, or in Byzantine versions of Hellenistic texts, such as the prediction of catastrophe leading to 55 years of cannibalism when mankind would dress in human skin.)[133] *4QBrontologion* resembles the textual structure of the standard protasis—apodosis formula recorded for Mesopotamian omina: (if *x* occurs [the ominous phenomena, a meteorological or planetary sign from heaven] . . . then *y* happens [the signified event on earth]).[134] The antiquity of this background is now examined, first, with a view to exploring the origins of the protasis of the Qumran brontologion (If it thunders in Taurus/Gemini . . .).

2.3.1 *Early Mesopotamian Lunar Omens and Thunder*

The remains of the Qumran brontologion contain standard apodoses that are mirrored throughout Mesopotamian omen history and reach a structurally composited form in texts such as the *Gestirn Darstellungen* tablets, as described in Chapter 1. We will now consider whether the protases to the omens in *4QBrontologion* (4Q318 viii 6b ירעם [אם בתורא] [*If in the Ox/Taurus*] *it thunders*; 4Q318 viii 9a אם בתאומיא ירעם *If in the Twins/Gemini it thunders*) may also derive from textual features in ancient Mesopotamian divinatory tradition.

Mesopotamian scientific and divinatory material known as "extraneous" texts carried authority in canonical Babylonian series due to their great antiquity.[135] There is no reason to assume that 4Q318 was without scholarly significance, or even that it was not canonical, in Second Temple society or at Qumran. Examples of lunar and thunder symbolism in ancient Mesopotamian divinatory texts will now be noted to illustrate the canonical presence of these elements in ancient protases.

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131 Rochberg, *Heavenly Writing*, 54.

132 A.K. Guinan, "A Severed Head Laughed: Stories of Divinatory Interpretation," in *Magic and Divination in the Ancient World* (ed. L. Ciraolo and J. Seidel; Ancient Magic and Divination 2; Leiden: Brill, 2002), 28.

133 C. Virolleaud, *L'astrologie chaldéenne* [ACh], Adad XVII, 36, cited by Weidner, *Gestirn-Darstellungen*, 16. (Weidner's translation: "55 Jahre lang wird der Mensch Menschenfleisch essen, wird der Mensch sich mit Menschenhaut bekleiden.")

134 For example, MUL.APIN Tablet II iv 11–12: "If a man is made a ruler, and the East wind blows: his days will be short," from Hunger and Pingree, *MUL.APIN*, 122: the omina in the MUL.APIN are contained in Tablet II iii 16–iv 12 (Text history, ibid., 13).

135 F. Rochberg-Halton, "Canonicity of Cuneiform Texts," *JCS* 36.2 (1984): 137–138, 144.

The following examples of protases are combined with apodoses containing the king and famine motifs so as to demonstrate the relationship between these combinations in antiquity and their appearance in the Qumran omen text. *4QBrontologion* (4Q318 viii 7, 8) describes the fall of a royal house and suffering caused by the failure of crops, either relating to the protagonist or an antagonist, or an ethnic group signified by a zodiac sign. The demise of the unnamed king from an unspecified province is distinguished from the fate of the Arabs, who may also be affected by the prediction for thunder when the moon in Taurus.

By contrast, in one lunar eclipse tablet of the Enūma Anu Enlil (*EAE*) (to take an example), the protasis relates to a lunar eclipse and does not specify any national group who may experience destruction, famine and the death of a king, either by natural causes or violence:

> If [there is a lunar eclipse] on the 14th day: There will be destruction and there will be perpetual famine and the king will die.[136]

In another tablet, the *EAE* lunar eclipse omen describes different forms of revolutions and the seizing of power, applied to specific crops, kingship and famine.

> If an eclipse occurs on the 14th day, the date palm will decrease (variant: will be diminished] . . . hunger [variant], famin[e . . . an effective king w]ho won renown will die in that year and his son, who [was not named for the kingship, will seize the throne and] . . . his land [will . . .] famine.[137]

Ivan Starr suggests that the prognostications were not meant to be taken literally, but rather as indications as to whether the outcome would be favourable or unfavourable.[138] Below, the combination of the protasis of the lunar phase and meteorological conditions, such as thunder (Adad),[139] in lines 5 and 8, is prefixed to a variant of the king, crop, invader apodosis in a seventh century B.C.E. report by a Babylonian diviner to an Assyrian king:

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136 Rochberg, *Lunar Eclipse Tablets*, for example: 254: *EAE* 22 I§II 1. See also Rochberg, *Heavenly Writing*, 66–78.

137 Rochberg, *Lunar Eclipse Tablets*, 129: *EAE* 17 § III.4. D ii 37.

138 I. Starr, "Historical Omens Concerning Ashurbanipal's War Against Elam," *AfO* 32 (1985): 61–63.

139 Adad: weather god of storms and beneficial rains, Koch-Westenholz, *Mesopotamian Astrology*, 55; Hunger and Pingree, *Astral Sciences*, 13; Rochberg, *Heavenly Writing*, 36, 67 (Shamash and Adad were also the gods of divination), 215.

SAA 8: 119: 1–8

1. [If the moon] becomes visible [on the first day:
2. reliable] speech; [the land will become happy].
3. [If the day] reaches its normal length: a reign of long days.
4. This (refers to) the visibility of the first day.
5. If Adad thunders at the gate of the moon: there will
6. be a fall of the army of Elam in battle; the possessions of
7. its land will be collected into another land.
8. This (refers to) that Adad thunders when the moon is seen.[140]

r.1. From Bullutu

The "moon gate" of SAA 8, 119: 5 appears to be unusual in omen texts; Wayne Horowitz proposes that the meaning of the "Adad thunders by the gates of the Moon" is related to the heavenly gates through which the moon, sun, Venus and the stars and constellations are said to enter and leave the heavens (that is, rising and setting) in Akkadian and Sumerian texts.[141] The symbolism of the gates also appears in *Enūma Elish* Tablet 5: 9–10 in which Marduk create gates through which the stars in the paths of Enlil and Ea can enter and leave the sky; however, in this context there are no omens.[142] In a thunder omen text more recently published, Erlend Gehlken, interprets the 'gates' as "openings in the rings of a halo or a corona" of the sun or the moon, and he suggests that this

140 H. Hunger, *Astrological Reports to Assyrian Kings* (State Archives of Assyria [hereafter SAA] 8; Helsinki: Helsinki University Press, 1992), no. 119; (K 00787 {Neo-Assyrian script}, RMA 256a, see R. Campbell Thompson, *The Reports of the Magicians and Astrologers of Nineveh and Babylon in the British Museum*, 2 vols. (London: Luzac and Co., 1900)); also see the Neo-Assyrian Text Corpus Project 1992 [NATCP] online for updates in the State Archives of Assyria series. The bulk of the corpus was written c. 670 B.C.E., see Koch-Westenholz, *Mesopotamian Astrology*, 55–56. I thank Dr Jonathan Taylor of the British Museum for mentioning this text (private communication).

141 W. Horowitz, *Mesopotamian Cosmic Geography* (MS 8; Winona Lake, IN: Eisenbrauns, 1998), 66, see also SAA 8, no. 458 [line 11 broken], cited in Horowitz, *Mesopotamian Cosmic Geography*, 267 n. 34.

142 *Enūma Eliš* 5: 9–10: "Gates he opened on both sides (of the heaven)/ Made fast the locks to left and right," translation, B. Landsberger and J.V. Kinnier, "The Fifth Tablet of Enūma Eliš," *JNES* 20 (1961), 157; W.G. Lambert, "Mesopotamian Creation Stories," in *Imagining Creation* (ed. M.J. Geller and M. Schipper; Leiden: Brill, 2008), 15–60, esp, 20–21, 48–49, comment on the calendar, 23–24; P. Talon, *The Standard Babylonian Creation Myth: Enūma Eliš* (SAACT 4, NATCP 5; Helsinki: Helsinki University Press, 2005), 95; J.L. Cooley, *Poetic Astronomy in the Ancient Near East* (Winona Lake, IN: Eisenbrauns, 2013), 146.

text parallels SAA 8, 119: 5.[143] SAA 8, 119 may suggest that the outcome would be unlucky if thunder occurs on the first day of a month (lines 4, 8). (In other omen texts for the opposite extreme of the month, the end of a month and the disappearance of the waning moon are good days for a thunderclap: the harvest will prosper and business will be steady.)[144]

The protasis contains both a reference to a variable weather omen, thunder, and a lunar phase, the first crescent. In the apodosis, normality equates with a positive prediction (lines 1–4), any natural phenomena which deviates from the ideal, on a spectrum from cloud-cover to thunder (personified by the storm god, Adad), signifies an incrementally worsening outcome. The protasis—apodosis for thunder at the "gate of the moon" (SAA 119: lines 5–7) is a standard catastrophic prediction. In *4QBrontologion*, a much later text, the zodiac sign of the moon constitutes a separate variable element in the protasis because the moon will be in a different zodiac sign according to the day of the month, hence its phase can be ascertained from *4QZodiac Calendar*.

The mantic meaning of omens concerning different kinds of weather conditions accompanying the thunder varies according to the particular month concerned. In contrast to 4Q318, these Akkadian texts are pre-zodiacal. If one substitutes the month for the zodiac sign,[145] these protases would be close to the form found in 4Q318 viii 6b, 9a. Thunder without clouds (an abnormal weather condition) in the month of Ab (Month V) foreshadows famine, or darkness.[146] A thunderstorm in Ab with rain and lightning has a similar outcome: drought;[147] and thunder without lightning will result in rains and a failed harvest.[148] A full-blown, normal thunderstorm in Tishri with thunder, clouds, rain, rainbow and lightning is auspicious: "the gods will have mercy on the land."[149] A thunderclap in Tishri (Month VII) without any of the accompanying meteorological phenomena (therefore, not normal) presages "hostility

143 E. Gehlken, *Weather Omens of Enūma Anu Enlil: Thunderstorms, Wind and Rain* (*Tablets 44–49*) (Leiden: Brill, 2012), 110, n.41, for Tablet 46, line 66: "If Adad thunders at the 'city gate' of the moon/sun, the king of Elam will fall by a weapon, [...] ...."

144 Hunger, SAA 8: nos. 354:1–3; 365:1–2.

145 Brack-Bernsen and Hunger, "The Babylonian Zodiac," 288; Brack-Bernsen and Steele, "Babylonian Mathemagics," 99–104.

146 Hunger, SAA 8, 001:4; 031:1–4r (Thunder in Ab is on the obverse: darkness and famine); 043:4 (Thunder in Ab in the strophe above; darkness); 80:4 (famine, ditto); 182:1 (famine, thunder in Ab).

147 Hunger, SAA 8, 001:1; 043:1; 031:4; 182:3.

148 Hunger, SAA 8, 80:1.

149 Hunger, SAA 8, 033:1.

in the land."[150] In the same collection, a different meteorological feature, when a south wind keeps blowing, is integrated into a protasis that anticipates a prediction involving a king and famine.[151] The combination of the type of wind and lunar eclipse is included in a prediction in a learned text written in Neo-Babylonian script (c.1000–625 B.C.E.) for 15 Sivan (Month III):

> [If the moon makes an eclipse], and the south wind keeps blowing: the king [...] and is small: famine [...][152]

Finally, to make the point that the apodosis of a king and famine were eclectic features in different kinds of Mesopotamian protases, from celestial phenomena to seismologies, the following textual examples are given. An omen prediction of famine and the overthrow of a particular king are extant in MUL.APIN for the protasis of the heliacal rising of Jupiter ("the Yoke"):

> If the Yoke is turned towards sunrise (?) when it comes out and faces the front of the sky, / and no wind blows: there will be famine, the dynasty will disappear;/ omen of Ibbi-Sin, king of Ur, who went in fetters/ to Anšan; after him his people weep, variant: fall.
> (MUL.APIN Tablet II IV 5–8)[153]

Similar apodoses occur in consecutive months for the protasis of an earthquake throughout the months in the omen series *iqqur îpuš*:

> Si, au mois de Nisan, se produit un tremblement de terre: le roi, son pays se révoltera contre lui.
> Si (c'est) au mois d'Aiar: le pays connaîtra la calamité (variation: une famine se produira).[154]

The system, above, of taking one protasis and applying it systematically in a chronological sequence throughout the 12 months, as if it were a textbook

150 Hunger, SAA 8, 444:1.

151 Cf. the south wind is in the protasis of VAT 7851 (Text 1a) line 1; and the north wind is in the protasis of VAT 7847+AO 6448 (Text 2a) line 1, see §1.3.2.

152 Hunger, SAA 8, 535:3–4r.

153 Hunger and Pingree, *MUL.APIN*, 120–121; The Yoke is possibly Jupiter, *MUL.APIN*, 146; The omina in MUL.APIN can be found in Tablet II iii 16-iv 12; E. Reiner and D. Pingree, *Babylonian Planetary Omens.* Part 3 (Cuneiform Monographs 11; Leiden: Brill, 1998), 23.

154 Labat, *Un calendrier babylonien*, no. 100:1–2, pp. 188–189.

("If there is an earthquake" in Nisan, Iyyar, and so on . . .), is an alternative yet similar presentation to the formula of *4QBrontologion* whereby the protasis of one zodiac sign can be applied to the moon's position in sequential zodiac zigns ("If it thunders" in Taurus, Gemini, and so on). In the micro-zodiac texts discussed in Chapter 1, there are no analogous protases on thunder according to the moon's zodiac sign; instead the protases relate to lunar eclipses in months and corresponding zodiacal 'triplicities': three zodiac signs apply to one of four cities, or geographical regions, or inhabitants of countries, so that one of the four kingdoms may be affected by any of the three signs in the same triplicity.[155] The conditional formula is the same.

This discussion has possible implications for how *4QBrontologion* would have been understood in Judea in the first century B.C.E. Wise's theory on the meaning of, for example, וחרבْ [בד]רת מלכא, "and a sword in the court of the king" (4Q318 viii 7) could be interpreted by the omen-reader of *4QBrontologion* as a violent *coup d'état* involving a Judean ruler.[156] To take on board Starr's perspective, it could also mean a threat to any leader in any place, or simply a general, standard negative forecast. Wise's speculation that *4QBrontologion* had a legitimate place in Second Temple literature and that it could have been read as the downfall of a particular Hasmonean king could be supported in the light of Mesopotamian omen texts whereby a thunder omen could predict the overthrow of a ruler. The Qumran protasis is a variation on late Babylonian zodiacal omen texts and the apodosis may have relevance in an apocalyptic environment. Since the literary style is clearly derived from Babylonian divination texts, there would be no need to add the kudos of a 'Chaldean' authority, as found in the Byzantine Greek versions, as that information may have been known. The next sub-section investigates the possibility that the technical structure of *4QZodiac Calendar* with *4QBrontologion* may have a Mesopotamian compositional precedent.

2.3.2 *A Mesopotamian Calendrical Text with Omens*

This sub-section discusses a Mesopotamian text that has a parallel structure to 4Q318. The astronomical lunar table K90 followed by "the curious subscript" of two omens[157] is possibly the only attested Babylonian calendrical text accompanied by the protasis-apodosis omen formula that bears some structural similarities to *4QZodiac Calendar* and *4QBrontologion*.

155 Rochberg, *Heavenly Writing*, 109. See § 1.3.3, The *Gestirn-Darstellungen* texts.

156 Wise, *Thunder in Gemini*, 49–50.

157 Al-Rawi and George, "Enūma Anu Enlil XIV," 66–68.

According to Farouk Al-Rawi and Andrew George, the lunar table gives the lengths of lunar visibility every night for one month, possibly the month of the winter solstice[158] and does not seem to be connected with the omen text with it. The protases-apodoses comprise two separate extracts from existing omen series (see below). Line 32 is taken from the solar section of *EAE* [Tablets 23 (24)–29 (30)][159] and line 33 is taken from *Šumma izbu* I, the treatise on human and animal birth malformations and anomalies, and omens.[160]

> 32: If the sun rises and becomes visible, but its light is gloomy: there will be plague in the land; the king will die and the enemy will plunder the land; (or,) ditto, the seat of the land will be scattered.
> 33. If a woman gives birth to a white ewe, (or) a cat: the prince will have no rival.

Neither the lunar table nor the omen unit is astrological (in the sense of using the zodiac or the constellations). Furthermore, the omens do not appear to be related to each other. The tablet, inscribed in neo-Babylonian script, is not typical of the tablets copied for Ashurbanipal's library at Kouyunik. According to Al-Rawi and George, both the lunar table (K90 lines 1–31) and the two omens (K90 lines 32–33) are scribal exercises. They state that the table is mathematically erroneous: that it contains information on the length of lunar visibility for every day of a schematic 30-day month, calculating by linear progression that the full moon would be visible on the longest night of the year, the winter solstice (15th Kislīmu), for 16 hours.[161]

Whatever the unit of time, and the intention of the ancient author, or copyist, may have been, the astronomical table has a contextual similarity to the zodiac calendar: day-by-day lunar calculations for a month, followed by practice omens. The combination of these two units in this arrangement may show

158 Al-Rawi and George, "Enūma Anu Enlil XIV," 67, following the interpretation by B.L. van der Waerden, "Babylonian Astronomy III: The Earliest Astronomical Computation," *JNES* 10 (1951): 20–34 (24).

159 Al-Rawi and George, "Enūma Anu Enlil XIV," 68 n. 55: identified as *EAE* 26 + x by E. Weidner, "Die astrologische Serie Enūma Anu Enlil," *AfO* 22 (1968–69), 65–75; and bibliography: J.A. Craig, *Astrological-Astronomical Texts*, 1899, pl. 50; C. Virolleaud, *ACh* Shamash *15*.

160 Al-Rawi and George, "Enūma Anu Enlil XIV," 68 n. 56; Leichty, *The Omen Series Šumma izbu*, 33; E. von Weiher, "Spätbabylonische Texte aus Uruk III," [*SpTU* 3] 14.

161 Al-Rawi and George, "Enūma Anu Enlil XIV," 67, following van der Waerden, "Babylonian Astronomy III," 24, cf. C. Michel-Nozières, "The Variation of Lunar Visibility Through the Year: Is There a Copyist Error in Table K90?" *Revue d'Assyriologie* 96.2 (2002): 143–147.

an early interest in the development of the formula consisting of a lunar table showing the changing position of the moon followed by omens, although their protases, particularly the second one, seem unconnected to the astronomical data. The question may be asked why it was done and whether it represented an early stage in the genre of a lunar table with an omen text. Since similar exercises and texts are unattested in classical Greek, Hellenistic, or Greco-Roman astronomical works, it may be suggested that the composited structure of 4Q318 is a Judean Aramaic innovation derived mainly from Mesopotamian scholarship.

The archaic literary style of *4QBrontologion* may have been influenced by the apodosis in the Babylonian thunder omen text tradition attested in the Assyrian tablets. The tradition of ascribing inhabitants of countries to particular zodiac signs is an astrological feature attested in late Babylonian zodiacal apodoses, as well as in Greco-Roman astrology, the Byzantine Greek omens with zodiac calendars, and the Qumran omen text. 4Q318 might also have been composited according to a style of scribal practices attested in some Babylonian lunar tables, of which K90 is an example.

2.3.3 *Excursus: A Note on Medieval Brontologia and Zodiac Calendars*

Different forms of brontologia, with and without the zodiac, were preserved in late antiquity and spread to Medieval Europe where astrological esoterica and prognostica were being studied and collected by scholars.

In his study on eleventh century Anglo-Saxon monastic thunder omen texts, Roy Luizza found that non-zodiacal thunder books found their way into Christian culture "as part of a larger interest in forecasting events by means of signs and portents. . . . ."[162] He argues that divination by thunder practised in the ancient world was also associated with the unusual signs or the voice of God in Bible.[163] One Middle English thunder book formulaically gives predictions (of death) according to the day of the week that the first thunder of the year was heard. The structure of the protasis and apodosis is similar to 4Q318 and the Byzantine brontologia, with the day of the week replacing the moon in the zodiac:

162 R.M. Liuzza, "What the Thunder Said: Anglo-Saxon Brontologies and the Problem of Sources," *Review of English Studies* 55 (2004): 1–23 (esp. 6–7, nn. 19, 20).

163 Examples of the voice of God as thunder may include: *Ps* 18:13 [Heb.]; 29:3; 77:19; 81:8 [Heb.]; 104:7; 1 *Sam* 7–10, *Job* 36:29–37.13; *Sir* 43:17.

1. In the present years if the first thunder comes on Sunday, that signifies the death of a royal child.
2. If it thunders on Monday, that signifies great bloodshed in some nation.
3. If it thunders on Tuesday, that signifies the failure of crops.
4. If it thunders on Wednesday, that signifies the death of tillers of the land and craftsman.
5. If it thunders on Thursday, that signifies the death of women.
6. If it thunders on Friday, that signifies then death of sea creatures.
7. If it thunders on Saturday, that signifies the death of judges and officers.[164]

Nicholas Sims-Williams highlighted a fragment of a Christian Sogdian text (Fragment e), probably based on Syriac originals, which contains protases for thunder and earthquakes for each month in the Syriac calendar. These two events are contained in the same strophes, either omen separated by their respective apodoses. Thunder and earthquakes are followed by the predictions for the sighting of rainbows in eastern directions, thereafter in western directions in sequential months. Subsequent omina relate to the horns of the moon, lunar eclipses and "rumbling (?)"[165] The standard apodoses have correspondences with *iqqur îpuš*.

The inclusion of the rainbow as ominous is intriguing in a religious text as it is also included in the hierarchy of natural phenomena (the onomastica) in Ben Sira (*Sir* 43:11–12), preceding the weather phenomena and winds (*Sir* 43:13–22). The association of thunder with earthquakes in Frag e 5r.21 to 5v.11 is further reminiscent of *Sir* 43:17a where thunder is personified as God's voice and makes the earth tremble. Again, the zodiac is not included.

José Chabás and Bernard Goldstein have recently published an interesting thirteenth century luni-solar zodiac calendar from the works of Danish mathematican and astronomer, Peter Philomena of Dacia (fl. 1292–1303), based on the sun's entry into the zodiac signs in the Julian calendar and the moon.[166]

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164 R.M. Liuzza, *Anglo-Saxon Prognostics: Studies and Texts from London, British Library, MS Cotton Tiberius A.iii* (Cambridge: Boydell and Brewer, 2010), t.12: 'Thunder Prognostic for Days of the Week, English,' 197.

165 Sims-Williams, "Christian Sogdian Texts from the *Nachlass* of Olaf Hansen II," 288–302 (at 294–302), (5r.21–6b.v).

166 J. Chabás and B.R. Goldstein, *A Survey of European Astronomical Tables in the Late Middle Ages* (TACTS 2; Leiden: Brill, 2012), table 7.2B, 87 (Vienna, Nationalbibliothek, MS 2367, fol. 9v), citing F. Saaby Petersen, "Petri Philomenae de Dacia et Petri de S. Andromaro," *Opera quadrivialia, Corpus Philosophorum Danicorum Medii Aevi* 10, 1–2 (Copenhagen,

In this text the moon traverses 12 signs in one month, not 13 signs, therefore it orbits 360°, not 390°, although it takes 30 days. The moon stays in each consecutive sign alternatively for two days and three days. The sequence of the moon's schematic transit of each zodiac sign per month is, therefore: two days-three days-two days-three days-two days-three days-two days- three days-two days-three days-two days-three days. The moon in January starts in Aquarius and ends in Capricorn; in February the moon begins in Pisces and ends in Aquarius. It would appear that the month begins on a schematic lunar crescent, that is the moon is one sign ahead of the sun which would be in Capricorn at the beginning of January, and Aquarius in the beginning of February, but as there are only 12 signs, the month is sidereal and there is, therefore, one sign missing for days between the end of one month and the beginning of the next month, as the authors noted.[167]

According to Eric Shane Bryan, two known zodiacal brontologia of three attested in Middle English manuscripts share approximately the same prognostications as a fifteenth century astrological Latin text contained in the miscellany *Summa astrologiae judicialis de accidentibus mundi* ("A summary of the judgements of astrology on the happenings in the world").[168] They were compiled by John Ashenden, an astrologer and Fellow of Merton College, Oxford, who was one of a scholarly circle of antiquarian collectors and practitioners dedicated to studying astronomy and astrology.[169] The next sub-section investigates how 4Q318 could have been utilised in Second Temple Judaism.

2.4 Purpose

Having researched the background and structure to 4Q318 in Chapter 1 and the previous sections, I will now evaluate the purpose and context of this scroll.

1983–4), 360. See Chabás and Goldstein, *Survey of European Astronomical Tables*, 86–88, for other calendrical references.

167 Chabás and Goldstein, *Survey of European Astronomical Tables*, 88.

168 The manuscripts are Cambridge, Trinity College MS R. 14.52, f.260v–261r, and London British Library Sloane MS 636, f.70r, in E.S. Bryan, "Prognostications by thunder in the zodiac: Mss Trinity R.14.52, Sloane 636, and PML M.775." *ANQ: A Quarterly Journal of Short Articles, Notes and Reviews* 19.4 (2006): 16–22, see also for bibliography and twentieth-century scholars who have studied medieval English thunder-books.

169 K. Snedegar, s.v. 'Ashenden, John (*d.* in or before 1368?)', *Oxford Dictionary of National Biography*, OUP, 2004 [http://www.oxforddnb.com/view/article/39190, accessed 2 March 2014]. J. Eschuid (John of Eschenden or Ashenden) *Summa astrologiae judicilis* (Venice: Johann Lucilius Santritter, 1489).

It is here proposed that the 4Q318 could be used *de facto* as a mantic tool, and also as an archaic literary and educational feature, possibly connected with mythological angels in Second Temple literature, a theory to be discussed in this section.

In the critical edition of 4Q318, Pingree appeared to rule out a link between *4QZodiac Calendar* and *4QBrontologion*, reasoning: "The implication is that there is a connection between the two parts of the text, but none is stated, and any such connection would create difficulties in interpretation."[170] This view is rejected; however, it is also very puzzling because Pingree compares a Byzantine Greek twin or parallel text with *4QBrontologion*, as discussed in this chapter.[171] Furthermore, Greenfield and Sokoloff pointed out that in MUL.APIN, a series of astronomical and weather omens in Tablet II immediately follows the astronomical section.[172] It is highly probable that the Qumran zodiac calendar of 4Q318 and the brontologion do belong together for the following reasons:

(a) Content. Both the reconstructed Aramaic brontologion and zodiac calendar begin with the moon in the zodiac sign of Taurus
(b) Scribal presentation. They are in the same manuscript, separated by a space on the same line
(c) Tradition history. There is textual support for a genre of a calendar with a related omen text in parallel medieval Byzantine secondary sources. Such a structure is attested in what may be an embryonic form in Lunar Tablet K90 (Section 2.3.2) in which practice omen inscriptions are placed after the lunar-calendrical table. The astronomical table has a contextual similarity to *4QZodiac Calendar*: day-by-day lunar calculations for a month.

One would infer from this juxtaposition that there is a relationship between these two units. For use as a mantic apparatus, it is likely that in order to interpret the meaning of thunder on a particular day, the prognosticator would consult the lunar zodiac calendar to determine the position of the moon in the

170 Pingree. DJD 36, "Astronomical Aspects," 271.

171 Pingree. DJD 36, "Astronomical Aspects," Greek twin text, (Suppl, gr. 1191 fol. 42v–47), 271–272.

172 Greenfield and Sokoloff, DJD 36, "4Q318," 270 ("The Juxtaposition of the Two Texts"); Hunger and Pingree, MUL.APIN, Tablet II iii 16–iv 12, pp. 108–122.

zodiac for the time that the thunder clap occurred.[173] The Babylonian omen texts reflect the philosophy that what happens in heaven is mirrored on earth. In a key primary source text known as a "Diviner's Manual," there is a repetition of the line "The signs of the sky just as those on earth give us signals."[174] The text advises the diviner how to manipulate the calendar by intercalation to avoid evil celestial omens manifesting on earth.[175] Drawing a comparison with the Mesopotamian belief of a direct relationship between heaven and earth, as if the unprovoked, natural celestial omen[176] were a message from the gods, the practitioner of 4Q318 could, theoretically, read out the meaning of the thunder from the brontologion after computing the moon's zodiac sign according to the calendar text.

As 4Q318 would be easy for a person with knowledge of the calendar and zodiacal astronomy to use, it could have been employed for literary and educational purposes. Omen divination narratives were a popular literary genre inside and outside first century Palestine. The popularity of portents from the heavens and signs on earth may be reflected in the stories by Suetonius on the auguries prior to the assassination of Julius Caesar, and the naming of Augustus.[177] Josephus's vivid account of the omens accompanying the siege of Jerusalem *J.W.* 6.289–300 (*J.W.* 6.310–315) features a number of supernatural signs. One of the portents, a heifer giving birth to a lamb as she was about to be sacrificed on a festival on Nisan 8 (*J.W.* 6.292) is a possible adaptation from the Old and Middle Babylonian omen series *Šumma izbu* series.[178] The series includes protases of cross-species births, particularly women giving

173 So F. García Martínez, "Magic in the Dead Sea Scrolls," in *The Metamorphosis of Magic from Late Antiquity to the Early Modern Period* (ed. J.N. Bremmer and J.R. Veenstra; GSCC 1; Leuven: Peeters, 2002), 30.

174 For example, in the key primary source text: Oppenheim, "A Babylonian Diviner's Manual," *JNES* 33 (1974): 197–220; H. Hunger, SAA 8, xiii; Brown, *Mesopotamian Planetary Astronomy-Astrology*, 108–113; Hunger and Pingree, *Astral Sciences*, 22–23.

175 Oppenheim, "Diviner's Manual," lines 24; 38–42; 43–46; 47–52; 53–56; C. Williams, "Signs from the Sky, Signs from the Earth: the Diviner's Manual Revisited," in *Under One Sky*, 473–487.

176 Provoked omens are those which are actively sought through divination rituals, such as extispicy; unprovoked omens are those which occur spontaneously: Koch-Westenholz, *Mesopotamian Astrology*, 10; Rochberg, *Heavenly Writing*, 66–97.

177 Suetonius, *Lives: The Deified Julius* 1.51, *The Deified Augustus* 2.7 (Rolfe, LCL).

178 E. Leichty, *The Omen Series Šumma Izbu* (Texts From Cuneiform Sources 4; Locust Valley, NY: Augustin, 1969).

birth to animals,[179] animals birthing another species,[180] and deformed births. Josephus's account modifies the omen to apply to kosher animals, yet contravening biblical law on mixed breeding (Lev 19.19)—hence an evil portent—and may be an instance of an omen from Mesopotamia adapted for a lay (possibly Jewish) readership.

The use of omen divination in non-sectarian literature is attested in the Dead Sea Scrolls. The lists of angels known from the section of the Ethiopic *Book of Enoch*, the *Book of the Watchers* (*1 En.* 1–36) are extant in no fewer than three separate manuscripts at Qumran copied at different times.[181] Josephus tells us that the Essenes took an oath to preserve the book of their sect and the names of angels (*J.W.* 2.142); there is no mention that the names were a required secret.[182] We next explore the relationship between *4QZodiac Calendar and Brontologion* and the legends of the descending angels in the Hebrew *Book of Jubilees* and the Aramaic *Book of Enoch* found at Qumran in order to further the discussion on whether 4Q318 was integral to popular literary motifs in Judea and if it may have had an educational purpose.

2.4.1 *The Skills of the Descending Angels*

Scholars have made little connection between the story of the angels who descended to earth and mated with human women in Gen 6:2, 4, to whom in the Aramaic scrolls they revealed unauthorised knowledge—sorcery, charms, the cutting of roots and plants—and brought wickedness onto the earth in the form of giants who ate human flesh and drank blood,[183] and possible angelic content in 4Q318. This sub-section will consider the textual

179 Leichty, *Šumma izbu*, 1.33:12: If a woman gives birth to an elephant, the land will be laid waste; 1. 32.6: If a woman gives birth to a wolf, the land will go mad; Rochberg, *Heavenly Writing*, 61, ref, Leichty, *Šumma izbu*, 1.7: If a woman gives birth to a dog: the owner of the house will die . . . the land will go mad; pestilence.

180 F. Reynolds, *The Babylonian Correspondence of Esarhaddon and Letters to Assurbanipal and Sin-šarru-iškun from Northern and Central Babylonia*, SAA 18, no. 128: Cow [Gives Birth to] a Lion; Leichty, *Šumma izbu,* v. 79: If a ewe gives birth to a lion and it has two mouths, the word of the land will prevail over the king.

181 The reference to fragments is taken from the *editio princeps* by Milik, *The Books of Enoch*: 4Q201 (4QEn^{a} ar), 4Q202 (4QEn^{b} ar), 4Q204 (4QEn^{c} ar). For bibliographic details see J. Fitzmyer, *Guide to the Dead Sea Scrolls*, 52–53; for a the latest edition of 4Q201, see M. Langlois, *Le premier manuscrit du Livre d'Hénoch* (Paris: Cerf, 2008).

182 Noted by Collins, *Beyond the Qumran Community*, 148.

183 4Q201 (4QEn^{a}) frag 1, col. iii (= *1 En.* 6:4–8:1); 4Q201 (4QEn^{a}) frag 1, col. iv (= *1 En.* 8:3–9:3, 6–8); 4Q202 (4QEn^{b}) frag 1, col. ii (= *1 En.* 5:9–6:4, and 6: 7–8); 4Q202 (4QEn^{b}) frag 1, col. iii

components of the Aramaic angelic myths, transmitted in *1 En.* 8:1–3 in relation to *4QZodiac Calendar and Brontologion*, namely that the omen text represents the teachings of one of the descending angels, רעמאל (Ra ʻm'el), the angel of thunder, and that the calendrical element of 4Q318 contains the instruction of angels who taught the calendar and astrology.

Armin Lange states that *4QBrontologion* rejects *1 En.* 8:3 (=4Q201 {4QEn[a]} frag 1, col iv lines 1–5, parallel 4Q201 {4QEn[b]} frag 1, col iii 1–5),[184] and that this thereby illustrates the diversity of material in Second Temple Judaism. By this he probably means that the thunder omen in 4Q318 is an example of a text that rejects the legend that the descending angels brought wickedness onto the earth,[185] and that the skills of the angels, may have been presented as benign, for the benefit of humankind in earlier versions of the story. Certainly, there is nothing intrinsically evil about the angelic skills in the list in the original '*1 En.* 8:3 corpus' in Aramaic, nor in the "Nephilim" of Gen 6.4a (cf. "giants" in the Septuagint). Literally, in that verse in Hebrew, they are the offspring of "the sons of the gods" and "the daughters of men" and in Gen 6.4c they are further described as "warriors [of God] (cf. "giants" in the Septuagint) who are from Eternity, Men of The Name":

המה הגברים אשר מעולם אנשי השם Gen 6:4c

This literal reading of the character of these offspring of the sons of the gods and daughters of the men may infer that Gen 6:4 describes angelic beings living on earth in a human form.[186] An alternative case may be that 4Q318 does

(= *1 En.* 8:2–9:4); 4Q202 (4QEn[b]) frag 1, col. iv (= *1 En.* 10:8–12), respectively, Milik, *BE*, 150–151; 157–158; 165–158; 170–172; 175; Nickelsburg and VanderKam, *1 Enoch*, 23–26, 28–29.

184 A. Lange, "The Status of the Biblical Texts in the Qumran Corpus and the Canonical Process," in *The Bible as Book: The Hebrew and Judean Desert Discoveries* (ed. E.D. Herbert and E. Tov; London: The British Library & Oak Knoll Press, 2002), 21–30 (at 21).

185 Discussions on the discrepant versions of the legend include: A.Y. Reed, *Fallen Angels and the History of Judaism and Christianity: The Reception of Enochic Literature* (Cambridge: Cambridge University Press, 2005), 5–51; M. Dacy, "The Fallen Angels in the Book of 1 Enoch Reconsidered," *Hen.* 33.1 (2011): 27–39; M. Goff, "Monstrous Appetites: Giants, Cannibalism, and Insatiable Eating in Enochic Literature," *JAJ* 1 (2010): 19–42; J. Ben-Dov, "Ideals of Science: The Infrastructure of Scientific Activity in Apocalyptic Literature in the Yahad," in *Ancient Jewish Sciences*, ed. J. Ben-Dov and S.L. Sanders (New York, 2014), 126–129.

186 Note, Pseudo-Eupolemus (before first century B.C.E.) alleged that Abraham could trace his lineage back to the giants, in Eusebius's *Praeparatio Evangelica, PrEv* 9.18.2, trans. R. Doran, in Charlesworth, *The Old Testament Pseudepigrapha*, 2:882. Doran notes that in the fragments astrology seems to be connected with the giants, see Introduction and

not repudiate the element of wickedness in the original '*1 En.* 8:3 corpus' of material but rather, that it works with it as a literary conceit. It is here suggested that 4Q318 shares the knowledge of the zodiac calendar by using angelology as a didactic instrument. The zodiac calendar and omen text poses as an angelic booklet, a material miniature scroll within the Aramaic Books of Enoch with an educational purpose at its heart.

In *The Book of the Watchers* (*1 En.* 1–36) Enoch relates his teachings about the courses of all the celestial bodies and the luminaries, and the calendrical implications (*1 En.* 2:1); *1 En.* 2:1[187] = 4Q201 (4QEn[a]) frag 1, col. ii 1;[188]= 4Q204 (4QEn[c]) frag 1, col. i lines 17–19.[189] Milik suggested that 4Q201 (4QEn[a]) might have been a school exercise copied from the master's dictation[190] and that it is "highly probable" that the text contained only the first part of *1 Enoch*. He dated 4Q201 (4QEn[a]) to the first half of the second century B.C.E.;[191] 4Q202 (4QEn[b]) to the middle of the second century B.C.E. and 4Q204 (4QEn[c]) from the early Herodian period, or the final third of the first century B.C.E.[192] He argued that the original composition of *1 En* 6–19 (*Visions of Enoch*) dates from the late third century B.C.E., an estimate which is disputed by Bhayro, and accepted by Stone and Reed.[193] If Milik's hypothesis that 4Q201 were a scribal dictation is correct, this may support the suggestion that 4Q318 had an educational role and was associated with the Enoch collection.[194] It is reasonable to suggest that the teaching of the zodiac calendar representing mythical for-

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new translation of *PrEv* 9.17.2–9, in *OTP*, 2:873–881. This would imply a literary tradition in which the giants were righteous. See also note on Abraham, pp. 242–243 n. 274.

187 Nickelsburg and VanderKam, *1 Enoch*, 21; G.W.E. Nickelsburg , *1 Enoch 1: A Commentary on the Book of 1 Enoch, Chapters 1–36; 81–108* (Hermeneia; Minneapolis, MN: Fortress Press, 2001), 150–151.

188 Milik, *BE*, 4Q201 (4QEn[a] frag 1 ii 1), 145–46, pl. 2 [4Q201 frag 1, col. ii= *1 En.* 2:1–5:6]. Milik states that the "feasts" are not mentioned in Ethiopic. It is found in the Greek codex, Cairo papyrus 10759, f 12r 8b–33v (*1 En*: 1–32:6) {also known as The Akhmim Manuscript and Codex Panopolitanus, see Knibb, *Ethiopic Book of Enoch*, 16–17}; 4Q204 (4QEn[c]) frag 1, col. i 17–19 omits the passage by homoeoteleuton, Milik, *BE*, 147; 184–188. pl. 9.

189 Milik, *BE*, 184–88, pl. 9. [4Q204 {4QEn[c]} frag 1, col i = *1 En.* 1:9–5:1].

190 Milik, *BE*, 139, 141.

191 Milik, *BE*, 141.

192 Milik, *BE*, 164, 178; So J.C. VanderKam, "The Book of Enoch and the Qumran Scrolls," in *The Oxford Handbook of the Dead Sea Scrolls*, 256.

193 Milik, *BE*, 140, 164, 178, 24. Cf. S. Bhayro dates *1 Enoch* 6–11 to the late fourth century B.C.E., see idem, *The Shemiḥazah and Asael Narrative of 1 Enoch 6–11* (AOAT 322; Münster: Ugarit, 2005), 7–9; M.E. Stone, "Enoch, Aramaic Levi and Sectarian Origins," *JSJ* 19.2 (1988): 159–170 (166–168); A.Y. Reed, *Fallen Angels and the History of Judaism and Christianity*, 1–2.

194 See H. Drawnel, "Some Notes on Scribal Craft and the Origin of the Enochic Literature," *Henoch* 31.1 (2009): 66–72 (70–72).

bidden knowledge was shared as part of the narrative of secret instruction, as evidenced by the 'school student' text of 4Q201.

Enoch's angelology and the emphasis on the unauthorised knowledge of the calendar permeating through to human beings is a significant sub-plot in the *Book of Jubilees*, some of which is extant in Hebrew in the Dead Sea Scrolls, and some of which is not (see next sub-section). Given its narrative focus in Second Temple literature one may propose that this calendrical-astronomy-astrology is likely to have existed in reality. The case is made, therefore, that due to the ubiquity of zodiac calendars during this period, as shall be explored in this study, that there is real astronomical in knowledge 4Q318. The omen text, then, may serve as a practical exercise: it challenges a student how to work out for themselves when the moon is in Taurus, and in Gemini, and the other signs of the zodiac without looking it up in *4QZodiac Calendar*.[195]

There are a few differences between the names of some of the angels and their teachings in different manuscripts, although, the names of relevant angels that concern 4Q318, thunder, lightning, the signs of the stars and the signs of the earth, sun and moon are extant in the Aramaic. The angels named in *1 En.* 8:1–3 are extant in the fragments: 4Q201,[196] 4Q202,[197] and 4Q202.[198] The sixth angel, Ra'm'el, appears in 4Q201 (4QEn^{a}) fragment 1, column iii, line 7, ל]רעמא, = *1 En.* 6:7, the name means *Thunder of God*,[199] or *God is my Thunder*.[200] Since in *4QBrontologion* "thunder" is a verb, so אם ירעם (4Q318 viii 6, 9), "If

195 In 4Q318 and the "Dodekatemoria scheme" this can be done by assigning each month to its corresponding zodiac sign, for example, Nisan equates with Aries, and noting that at each seventh of the month, the 7th, 14th, 21st and 28th the moon is in the same sign of the zodiac for three days in the same quadruplicity as the month-sign. The quaduplicities are known from later Hellenistic astrology in Ptolemy's *Tetrabiblos* I.11 (though this is not evidence that there was not an earlier origin). They are Cancer, Capricorn, Aries and Libra (the 'solstitial' and 'equinoctial' signs); Taurus, Leo, Scorpio and Aquarius (the 'solid' signs); and Gemini, Virgo, Sagittarius and Pisces (the 'bicorporeal' signs) signs. The student or diviner can work out the moon's position for those days by memorising the groups of signs, and for the days in between by reckoning according to the schematic pattern.

196 4Q201 (4QEn^{a}) frag 1 col. iv lines 1–4, see Milik, *BE*, 157, 158 pl. 4; 159–161 (first copy) [4Q201 frag 1 col iv = *1 En.* 8.3–9:3, 6–8].

197 4Q202 (4QEn^{b}) frag 1 col. ii lines 26–29, see Milik, *BE*, 165–68, pl. 6; 168–170 (second copy) [4Q202 frag 1 col i = *1 En.* 5:9–6:4 and 6:7–8:1).

198 4Q202 (4QEn^{b} ar) frag 1 col.iii lines 1b–5a, Milik, *BE*, 170–71 pl. 7 frags p, q. (second copy). [4Q202 frag 1 col iii = *1 En.* 8:2–9:4].

199 Milik, *BE*, 153; Knibb, *Ethiopic Book of Enoch*, 70, 72.

200 M. Langlois, "Shemihazah et Compagnie(s): Onomastique des Anges Déchus dans les Manuscrits Araméens du Livre d'Henoch," *Aramaica Qumranica*, 153; Knibb, *Ethiopic Book of Enoch*, 70.

it thunders…,"[201] could equally be translated "If he thunders….". If so, it supports the theory that this thunder omen book was regarded as the teaching of this angel, the prediction being the result of reckoning the position of the moon in the zodiac on any day in the year.

It is a moot point whether all references to books in ancient works were real, or legendary;[202] for example, the *Book of Jubilees*, parts of which have been found at Qumran from several manuscripts may be referred to in other fragments of the Dead Sea Scrolls.[203]

Milik observed that the Aramaic construct נחשי followed by the angelic instruction is applied only to the angels who taught "astrological, meteorological and cosmological sciences" in 4Q201 frag 1, col. iv lines 2–4 (and parallel text 4Q202 frag 1, col. iii lines 2–5) = *1 En.* 8.3. He noted that the term means "'fortunes, fates,' doubtless horoscopes and auguries taken from the position of the stars and from natural phenomena…"[204] The angels in 4Q201 frag 1, col. iv lines 1–4 and 4Q202 frag 1, col iii lines 3–5 (= 1 En. 8:3) whose skills are prefixed by נחשי, are: Baraq'el ברק אל *Lightning of God*; Kôkab'el כוכב אל, *Star of God*; Zêq'el זיק אל *Lightning-flash of God*; Ar'teqoph, ארעתקף [Earth *is might*; Šhamši'el אל שמשי; *Sun of God*; Śahrî'el שהרי אל *Moon of God*.[205]

201 Parsed as 3rd-person masculine singular Aramaic *peal* imperfect.

202 L.H. Schiffman, "Pseudepigrapha in the Pseudepigrapha: Mythical Books in Second Temple Literature," *RevQ* 21.3 (2004): 429–438, argues against the physical existence of named mythical books in intertestamental literature.

203 4Q217 (4QpapJub^{b}?) *4QpapJubilees^{b}?* J.C. Vanderkam and J.T. Milik, DJD 13, 23–33, pl. 3; 4Q228 *4QWork with citation of Jubilees*, frg 1, i 1, 9–10, ibid., 178–185, pl. 12; 4Q384 (4QApocrJer^{b}) *4QApocryphon of Jeremiah^{b}*(?) frg, 9 2, M. Smith, DJD 19, 136–152, pl.16; CD-A (4Q266) xvi 3–4; 4Q271 (4QD^{f}) *4QDamascus Document^{f}* frg 4 ii 5, J.M. Baumgarten, DJD 18, 178–179; Hempel, "The Place of the Book of Jubilees at Qumran and Beyond," 191–193; VanderKam, "Revealed Literature," 25, states that CD 16: 3–4 contains a citation to Jubilees; against this general view, see D. Dimant, "Two 'Scientific' Fictions: The So-Called Book of Noah and the Alleged Quotation of Jubilees in CD 16: 3–4," in *Studies in the Hebrew Bible, Qumran, and the Septuagint Presented to Eugene Ulrich* (ed. P.W. Flint et al.; SVT 101; Leiden: Brill, 2006), 230–249 (esp. 242–248). Against Dimant's refutation of the alleged Book of Noah, and the supposed citation of *Jubilees* in CD 16: 3–4, see M.E. Stone, "The Book(s) Attributed to Noah," *DSD* 13.1 (2006): 4–23 (esp. 9 n. 17; 15–17).

204 Milik, *BE*, 160; from נחשא (Heb. s.v. נחש, "To practice divination," *BDB,* 638–9); see Black, *Book of Enoch*, 128. H.-J. Fabry, s.v. נחש, "seek or give omens, prognosticate," TDOT, 9. 356. 1a.

205 Milik, *BE*, 157, 170; Langlois, *Le premier livre*, 234–234 (Baraq'el), 205–206 (Kôkab'el), 259–261 (Zêq'el), 245–246 (Šhamši'el), 210–213 (Śahrî'el); Milki, *BE*, 152–154, Langlois, "Shemihazah et Companie (s)," 174–175; Bhayro, *The Shemihazah and Asael Narrative of 1 Enoch 6–11*: 61–62, 132–5, 152–156; Knibb, *Ethiopic Book of Enoch*, 69–75, 81–83.

The list of angels in *1 En.* 6.7 and the original Aramaic text (4Q201 frag 1, col. iii 5–12; 4Q202 frag 1, col i 15–17);[206] appears in a different order and are fewer in number than those in the angelic roster of *1 En.* 8:1, 3. Ra'm'el is among the 11 angels who are not mentioned in *1 En.* 8:1, 3, but in *1 En.* 6:7 only.[207] He may have been composited with the angel of lightning-bolts, Baraq'el, who is the nineth angel in 4Q201 frag 1, col. iii line 8; 4Q204 frag 1, col. ii line 26 = *1 En.* 6:7; and the fourth named angel-teacher in 4Q201 frag 1, col. iv line 2; 4Q202 frag 1, col. iii lines 2–3 = *1 En.* 8:3: ([ברקאל אלף נחשי ברקין] ["Baraq'el taught the signs of lightning flashes"]. In the Hebrew *Book of Jubilees* in the Dead Sea Scrolls, the angels of thunder and lightning (*Jub.* 2.2) are composited, rather prettily, as מלאכי הקולו[ת (4Q216 col. v line 7)[208] "the angels of the sounds," or, "angels of the voices."[209]

In the *Book of Watchers* (*1 En.* 1–36) secrets of divination by thunder and other meteorological phenomena are present only in the teachings of the angels to people on earth and not specifically to Enoch during his heavenly sojourn. The integral celestial and meteorological components of the calendar:

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206 For *1 En.* 6:7: Milik, *BE*, 4Q201 angel list: 150–151 (Ra'm'el is extant only at 4Q201 frag 1 col. iii line 7); 4Q202 angel list: *BE*, 166–167.

207 Nickelsburg and VanderKam, *1 Enoch: A New Translation*, 24; R.H. Charles, *The Book of Enoch or 1 Enoch Translated from the Editor's Ethiopic Text* (Oxford: Clarendon, 1912), 15–32 (esp. Notes to text and Appendix on *1 En.* 6:7); Milik, *BE*, 152–157, 159–161.

208 VanderKam and Milik, DJD 13, 13–15, pl. 1.

209 In 4Q216 col. v line 7 (*Jub.* 2.2) the angels of the spirits of [clouds] "and angels of sounds [or voices]" . . . . . ומלאכי הקולו[ת] may be a synonym for thunder and lightning. (Thunder as God's voice is reflected linguistically in: Sir 43:17a; Ps 29:3; Job 37: 4, 5; 2 Sam 22:14; thunder as a meteorological event caused by God, cf. 1 Sam 7:10; 1 Sam 12:17, 18; Job 28:26, 38:25; Exod 9.23, 28, 29, 33, 34; 19:16, 20:15); see also 1QH[a] (*1QThanksgiving Psalms*) col. xi line 34; 4Q370 (*4QAdmon Flood*) col. i line 3; 4Q391 (*4Qpap Pseudo-Ezekiel[e]*) frags 6–7, line 3.

The phrase in 4Q216 col. v line 7 is translated as "the angels of the thunder" by Abegg and Wise in *Dead Sea Scrolls: A New Translation*, 320, and "the angels of thunder[s]" in García Martínez and Tigchelaar, *DSSSE* 460–461. VanderKam argues that in the Hebrew text—the angels of sounds, without the addition of thunder and lightning—refers to "another group of angels," in contrast to the other textual witnesses, which add thunder and lightning: notes to 4Q216 col. v lines 7–8, DJD 13, 15.

Cf. *Jub.* 2:2: ". . . the angels of the spirits of the winds; the angels of the spirits of the clouds, of darkness, snow, hail and frost; the angels of sounds, the thunders and the lightnings . . ." J.C. VanderKam, *The Book of Jubilees* (CSCO 510–511, S A 87–88, vol. 511; Leuven: Peeters, 1989), 7–8.

the courses of the sun, moon and stars, and thunder, are revealed to Enoch in the *Book of Jubilees*.[210]

An intertextual connection in the pseudepigraphal books and the Dead Sea Scrolls concerned with the antediluvian patriarch is apparent. Enoch wrote down "everything" כול, having been taught cosmological knowledge by the angels during his six jubilees of years (300 years) in heaven (4Q227 (4QpsJub^{c}?) frag 2, lines 1–6,[211] cf. *Jub*. 4.17–18, 21). There is a similar reference to the transmission of angelic knowledge to Enoch in the *Genesis Apocryphon* (1QapGen ar) col. ii lines 20–21a: "they showed him everything, כולא."[212]

Knowledge of a sevenfold calendar consisting of a fixed pattern of months, weeks of jubilees and sabbaths of years driven by an astronomical order led by the sun, may be part of that knowledge in the theology of *Jubilees* (*Jub*. 2. 8–10; cf. 4Q216 col. vi lines 5–9);[213] however, the fixed, 52-week year Jubilean calendar is absent from *1 Enoch*.

The age of Enoch, 365 years (Gen 5.23), the number of days in the solar year, is a linking underlying theme between the two books.[214] According to

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210 VanderKam, *Book of Jubilees*, 25–27; for a separate commentary on this pericope, J.C. VanderKam, "Enoch Traditions in Jubilees and Other Second-Century Sources," in *From Revelation to Canon* (SJSJ 62; Leiden: Brill, 2000), 305–331 (esp. 310–314), originally published in *Society of Biblical Literature Seminar Papers* 1, (1978): 229–251 (232–234). VanderKam agrees with Charles's statement that there is a "delightfully clear reference to the *AB*," in *Jub*. 4.17b ("Enoch Traditions," 313–314 n.40 {re: R.H. Charles *The Book of Jubilees or the Little Genesis* (London: A & C. Black, 1902, repr. Jerusalem: Makor, 1972), 36)}). VanderKam compares *Jub*. 4.17b to *1 En*. 82: 4–9; however, a direct connection cannot be proved.

Milik draws further parallels between 4Q227 frg 2 5–6, and *1 En*. 80:7, see Milik, *BE*, 12, 24–25, 60–61; VanderKam and Milik, DJD 13, 171–175, pl. 12.

211 VanderKam and Milik, DJD 13, 173–174, pl. 12. Cf. 4Q204 col. vi line 12.

212 20b "…since he [Enoch] is the beloved and favourite [of God, with the holy ones] 21. his inheritance is found and they showed him everything כולא…," García Martínez and Tigchelaar, *DSSSE* 30–31.

213 J.C. VanderKam and J.T. Milik. *Qumran Cave 4: VIII. Parabiblical Texts. Pt 1*, DJD 13 (Oxford: Clarendon, 1994), 8–9, pls. 1–2.

214 In the *Jubilees* chronology (see VanderKam, *Jubilees*, 25–27), Enoch is 60 when he married his niece; 65, when Methuselah was born; and he spent 300 years with the angels; converted to *anno mundi* chronology: he was born in 522 AM (*Jub*. 4:16); the marriage: 582–88 AM (*Jub*. 4:20a,b); the birth of Methuselah: 587 AM (*Jub*. 4:20c), which corresponds with the chronology of Gen 5: 21–24. The total age of Enoch's life is 365 years; this sum total may be reflected in the exposition *Jub*. 4:21, the rulership of the sun (cf. the domination of the sun in the Creation *Jub*. 2:9–10 = 4Q216 col. iv lines 7–9) and refer to a 365–day solar year. It may be exegeting the biblical formula of a day for a year of Ezek 4.6b;

VanderKam, texts pertaining to revealed knowledge were a type of canonical literature in Second Temple Judaism.[215] Hence, the *Book of Jubilees* and *1 Enoch*[216] would have had this status. Colless demonstrates that the teaching of revealed wisdom and scientific knowledge by a supernatural agent to a legendary figure is a well-known genre in the ancient Near East.[217] The nature of the imparted wisdom could take the form of explicating skills to foretell the future.

It is possible that *4QZodiac Calendar and Brontologion* was a mythical book containing didactic information about the course of the sun, moon and stars and the angelic secrets of thunder, lessons taught by the descending angels of divination in the *Book of Enoch*. It is a manuscript that may be perfectly compatible with the Qumran or general Second Temple literary interest in wider divination practices (as discussed in the Introduction and the beginning of this section), and zodiac calendars whether Babylonian, or Hellenistic (the latter are discussed in Chapter 4). This analysis concurs with Lange's implication that the author of 4Q318 knew of a benign angelology in Aramaic related to Gen 6:2,4. I offer the view that 4Q318 represented the teachings of the calendrical angels, of the sun, moon and stars and the angel of thunder, Ra'm'el, an angel actually not in the original *1 En.* 8:3 list but in *1 En.* 1.6, and that it was used to explicate the zodiac calendar from Babylonian astronomy in the *Kalendertexte*. As there is no linguistic incompatibility between 4Q318 and the Aramaic fragments of the Book of Enoch, neither are they in code, nor in a cryptic script, it is not impossible that 4Q318 was a part of this corpus, an expansion and variation of the biblical text that scholars argue was widely known in Second Temple Judaism.

The discussion above puts forward another reason why 4Q318 should not be considered as an outsider text at Qumran, rather, it should be reconsidered as part of the rich textural layers of angelic "Enoch" literature in the second century B.C.E. to the first century C.E. It may be related to a more mystical and benign interpretation of, or background to Gen. 6:4 in a now-lost source.

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and the allusion to days being the equivalent of years in Gen 29:20. Thus, the length of Enoch's life, the scriptural calendar rule and the 365-day solar year may explicate the preeminence of the sun in Jub. 2:9–10 and 4: 21). *Jubilees* is also interested in exegeting the age of Adam when he died at 930 years old, that is, 70 years from 1000 years (*Jub.* 4.29), it states that one day in heaven is the equivalent to 1000 years on earth (VanderKam, *Jubilees*, 30; VanderKam, *Jubilees* {2001}, 34); cf. *Jub.* 23: 15, 25, 27.

215 VanderKam, "Revealed Literature in the Second Temple Period," in *From Revelation to Canon*, 1–30 (esp. 24–29).

216 VanderKam, "Revealed Literature," ibid. (esp. 25–26).

217 Colless, "Divine Education," *Numen* 17.2 (1970): 118–142 (esp. 122, 129, 136–137, 140).

2.4.2 *Divine Poetry: The Stars in Liturgical and Literary Texts*

This sub-section will argue by example that the theme of the orbits of the luminaries, the sun, moon, and stars, and an understanding of their integral relationship to the concept of the proper Time, which meant the co-ordination of religious practice with the calendar, was incorporated into religious poetry and liturgy in the Dead Sea Scrolls. Furthermore, this divine poetry may be found in a cross-section of non-biblical doxological texts, those that have been categorised as "sectarian" and those that have not. There is a common theme of praise to all the celestial bodies, their heavenly circuits and the cosmological order of days, months, years, seasons, and turning points of the year (תקופות *tequfot*: literally, the solstices and equinoxes in modern use; however, the term may be used with a more flexible astronomical meaning in the Dead Sea Scrolls).[218] Of relevance to this study is the interest of the role of the stars, in particular, as well as of the sun and the moon in the organisation of time. Explored from the point of view of the zodiacal calendars, it may be possible to read some prayer texts in a different light.

The appearance of the stars can signify the moment for humans to join in praise with the angels.[219] The association of the angels joining the stars in

218 Translated as "turn," "circuit," "course," "season," in the *Dead Sea Scrolls Electronic Library* [*DSSEL*], ed. E. Tov, revised edition, 2006. In this section, 1H[a] (Hodayot[a], or Thanksgiving Psalms[a]) col. xx lines 8, 9, 11 (in DJD 40, 259, cf. the verse numbering is different in the *DSSEL*) and 1QS (1QThe Rule of the Community) col. x lines 1, 2, 3 (see sub-unit). There are some 18 occurrences of the noun in the Dead Sea Scrolls in different forms and spellings.

219 B. Nitzan, *Qumran Prayer and Religious Poetry* (trans. J. Chipman; STDJ 12; Leiden: Brill, 1994), 47–69 (55–56 n. 29 on angelic song and the appearance of the luminaries, including 4Q503 frags 7–9 col. iv lines 34; frag 10, col. v lines 1–2; frags 29–32, col. viii lines 10–11; 4Q502 frag 27, lines 1–4); eadem, "The Dead Sea Scrolls and the Jewish Liturgy," in *The Dead Sea Scrolls as Background to Postbibical Judaism and Early Christianity: Papers from an International Conference at St Andrews in 2001* (STDJ 46; Leiden: Brill, 2003), 195–219 (219, summary of daily prayers and the entrance of the luminaries, including 1QS col. x lines 1–3; 11QPs[a] col. xxvi {*Hymn to the Creator*}; 4Q503{*4QDaily Prayers*}); eadem, "The Idea of Creation and Its Implications in Qumran Literature," in *Creation in Jewish and Christian Tradition* (ed. H. Graf Reventlow and Yair Hoffman; JSOTS 319; Sheffield: Sheffield Academic Press, 2002), 240–264; D.K. Falk, *Daily, Sabbath, and Festival Prayers in the Dead Sea Scrolls* (STDJ 27; Leiden: Brill, 1998), 59–214, 246, 262; E.G. Chazon, "Liturgical Communion," 95–105; eadem, "Human and Angelic Prayer," 35–48 (esp. 39); R.C.D. Arnold, *The Social Role of Liturgy in the Religion of the Qumran Community* (STDJ 60; Leiden: Brill, 2006), 43–47, 106–158; E. Regev, "Were the Priests All the Same? Qumranic Halakhah in Comparison with Sadducean Halakhah," *DSD* 12.2 (2005): 169–173; H.W. Morisada, "The Qumran Concept of Time," in *The Dead Sea Scrolls and the Qumran Community* (vol. 2 of *The Bible and the Dead Sea Scrolls*, ed. J.H. Charlesworth; Waco, TX: Baylor University

praise is attested in the Bible and the Dead Sea Scrolls, in Ps 148:1–6; Job 38:7; 11Q10 (11QTargum of Job) col. xxx lines 4–5: the stars as animate beings singing with those on earth: 4Q88 (4QPs[f]) (Apostrophe to Judah) col. x lines 5–6; and the stars as angels: Bar 3:34.[220]

The selected extracts from texts below comprise some examples of poetical, sapiential and liturgical texts. Notably, the sun need not be the exclusive, or incontrovertibly, the preferred luminary and the stars are incorporated into liturgical time in several sources.

Creation of stars. 4Q381 (*4QNon-Canonical Psalms B*) frag 1, lines 3–8.[221]

Schuller describes 4Q381 (*4QNon-Canonical Psalms B*) fragment 1, as a "'creation psalm'"[222] that "provides another extra-biblical example of an extended retelling of the account of creation in a psalmic context."[223] She adds that "the order is not directly dependent on Genesis 1" and "nor does it appear to follow the precise order of retelling in other creation psalms."[224] 4Q381 frag 1, line 5 (see extract) is a rewriting of the creation of the stars in Gen 1:16.

5 לילה וככ[בי] ם וכסילים
7 וברוחו העמידם למשל בכל אלה באדמה ובכל [...]
8 [לח]דש ב[ח]ד̇ש למועד במועד ליום ביום...

5 night, the stars and the constellations.....
7 And by his spirit he appointed them to rule over all these on earth and over all[...]
8 [mo]nth by [mo]nth, appointed time by appointed time, day by day...

Press, 2006), 203–234. D.T. Olson, "Daily and Festival Prayers at Qumran," in ibid., 301–315; T. Elgvin, "4QMysteries[c]: A New Edition," in *From 4QMMT to Resurrection. Mélanges qumraniens en homage à Émile Puech* (STDJ 61; ed. F. García Martínez et al.; Leiden: Brill, 2006), 75–86, see 4Q301 (4QMysteries[c]?) frag 2b, lines 4–7 (pp. 78–79) and frag 4, lines 2–4 (pp. 81–82).

220 See also I. Zatelli, "Astrology and the Worship of the Stars in the Bible," *ZAW* 103.1 (1991): 93–94.

221 E.M. Schuller, DJD 11, 92–94, pl. 9; *DSSSE* 754–755.

222 Schuller, DJD 11, 91–92.

223 Schuller, DJD 11, 92. Other 'creation psalms' mentioned by Schuller include, Sir 42:15–43.33, Hymn to the Creator (11QPs[a] col. xxvi, lines 9–15), 1QM col. x, lines 8b–26; 1QH[a] col. ix, lines 1–22 (= col. i, lines 1–20), 4Q380 frag 7, col. ii, lines 2–3; 4Q392, frag1, col i, lines 1–9.

224 Schuller, DJD 11, 93.

4Q381, frag 1, line 5 pays attention to the pairing of "the stars and the constellations," a phrase which does not exist in Genesis, but does echo Isa 13:10a (כוכבי־השמים וכסיליהם "Because the stars of heaven and their constellations . . ."). However, in 4Q381, frag 1, the sun and the moon are not mentioned. Elsewhere, in the biblical texts, Job 38:31, Job 9:9 and Amos 5:8, כסילים is understood as the name of a specific constellation, generally believed to be Orion,[225] and the sun and the sun and the moon are not mentioned either.

The hierarchical arrangement of the luminaries in the Dead Sea Scrolls is the sun, moon and stars[226] (as it is in *Ben Sira* 43: 1–10), following the order of the priority of the Lights in Gen 1:16.[227] However, Isa 13:10a, with which there seems to be an intertextual relationship with 4Q381 frag 1, line 5, prioritises the stars: "the stars of heaven and their constellations" before the sun (Isa 13: 10c), which precedes the moon (Isa 13:10d). A somewhat similar yet different arrangement appears to be reflected in the Aramaic *The Genesis Apocryphon* (see discussion continued in the next text).

Regarding a separate observation, 4Q381 frag 1, line 7 is a fascinating rewriting of Gen 1:28 composited with Gen 2:7. It is followed in line 8 by an apparent extended reference to the role of the luminaries for the calendar and appointed times, alluding to Gen 1:14b. Of note, 4Q381 frag 1, lines 5–8 also bears a similarity to *Jub* 2:8–10 (4Q216 col. vi lines 5–9) (see 4Q216 (4QJub[a]) col. vi lines 5–8, below) in that it is rewritten Creation with an adaptation to Gen 1:14b to include the months (Gen 1:14b does not do so). There is no reason to posit in this context that the schematic fixed months of the Jubilees-Qumran calendar, as opposed to astronomical, lunar months, are meant in this psalm. Schuller argues that the text antedates the Qumran community and that it was preserved there, thereby originating within wider Jewish circles.[228]

225 For example in the RSV, TNIV, JPS.

226 The hierarchical order of the sun, moon and stars/ *mazzalot*/ host of heaven/ constellations" or "moon and stars": DSS: 1Q20 *1QapGen ar* col. vii line 2 (see below), col. xiii lines 10b–11a; 4Q213 *4QLevi[a] ar* frg 3+4 2; 4Q216 (*Jub* 2:8) col. vi line 5; 4Q392 *4QWorks of God* frag 1, line 6; 4Q458 *4QNarrative A* frag 2, col. i line 2.

227 Gen 37:9; Deut 4:19; Deut 17:3; 2 Kgs 23:5; Ps 148:3; Eccl 12:2; Jer 8:2; Jer 31:35; Ezek 32:7; Joel 2:10, 3:15; 1 Chr 15:41; Ps 148:3; Song 6:10: moon, sun, bannered host נגדגלות (JPS); or army with banners, RSV; "stars in procession," TNIV; "moon and stars" only: Job 28:2; Ps 8:3; Ps 139:6. (So also the New Testament, Matt 24:29; Luke: 21:25; Rev 8:12, 12:1).

228 Schuller DJD 11, 90; McAleese, "Actualizing Israel," 223–224.

Mazalot of Heaven. 1Q20 (*The Genesis Apocryphon* 1QapGen ar) Col vii, Line 2[229]

Interestingly, in 1Q20 (*The Genesis Apocryphon*. 1QapGen ar) col vii, line 2, the order of the luminaries: the sun, moon and the stars, is preceded by "all the constellations *mazalot* of heaven," כול מזלת שמיא. Following "all the constellations of heaven," the hierarchical order of the sun, moon and stars as given in Gen 1:16 then assume their biblical, literary positions.[230]

1Q20 (*1QapGen ar*) (*The Genesis Apocryphon*) *col. vii, line 2*

○○דא כול מזלת שמיא שמשא שהרא וכוכביא . . .
[. . .] all the *mazalot* of heaven; the sun, the moon, and the stars . . ."

1Q20 col vii, line 2 resembles the striking departure from the heavenly order found Isa 13:10 where, the "constellations," כסילים take priority. Yet, whereas in 4Q381 frag 1, line 5 and Isa 13:10 the "stars" and the כסילים "constellations," are grouped together, in 1Q20 col vii, line 2a, the *mazalot of heaven* are separated from the "stars" which are placed behind the sun and moon, in that order, and is a construct noun with "of heaven." This may suggest that the *mazalot* in line 2a are conceptually different in an Aramaic context to the "stars and constellations" of Isa 13:10. According to Arthur Beer, the term *mazalot* in the Hebrew Bible may refer to the zodiac signs and stars of fate in Aramaic.[231]

The isolation of stars and the כסילים "constellations" in 4Q381 frag 1, line 5 in relation to the sun and moon suggests that they may have a similar role to the Aramaic "all the *mazalot* of heaven" in *The Genesis Apocryphon* because in both cases they appear as separate entities to the sun and moon. However, if כול מזלת שמיא "all the *mazalot* of heaven" is a reference to the stars of fate, the כסילים, "constellations," of 4Q381 may mean the moon's signs as the term is combined with the stars and calendrical time. "All the *mazalot* of heaven" in *The Genesis Apocryphon* are treated separately (not calendrically).

229 J.A. Fitzmyer, *The Genesis Apocryphon of Qumran Cave 1* (*1Q20*) (Rome: EPIB, 2004), 78–79, 150.

230 (So 1Q20 xiii 10b–11: "(10b). And I watched the sun and moon (11.) and the stars (they) were chopping . . .") (translation: D.A. Machiela, *The Dead Sea Genesis Apocryphon* (STDJ 79; Leiden: Brill, 2009), 58.

231 See A. Beer, "Astronomy," *EncJud*, 3:795; BDB, 561 suggests that the noun means "constellations, perhaps signs of the zodiac;" in Aramaic it means "star of fortune or fate" and it is a loan-word from Assyrian: *manzaltu, mazaltu*, meaning "station, or abode (of gods)." Fitzmyer translates the word simply as "constellations" in *The Genesis Apocryphon*, 79, 150.

The Genesis Apocryphon does not here seem to use מזלת in a pejorative sense. In contrast, the biblical use of the noun, a *hapax legomenon*, is certainly understood negatively in its particular context in 2 Kgs 23:5, as associated with an idolatrous practice to be condemned, that of worshipping the stars.[232]

In their mazalot. 4Q287 (4QBerakhot^{b}) Fragment 1, line 1–5[233]

Similarly, in the Hebrew text, (4QBerakhot^{b}) fragment 1, line 2, the *mazalot* are not used in a negative sense. Here, they are combined with the "Lights" (line 1) and the "appointed times," (line 3) reflecting the order of Gen 1.14 in which the Lights are created first in order to themselves determine the appointed times in the calendar. The *mazalot* are probably the constellations, the stars of Gen 1:16, so creating the conventional hierarchical arrangement in which the stars follow the sun and the moon (see the discussion in *The Genesis Apocryphon* above), and thereby placing the appointed times after the stars.

4Q287 (4QBer^{b}) 1–1:5

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1.] ומאורֹ֗ים
2.]◦הם במזלותמה
3.]◦הם בכול מועדי
4.]כולמה אמן אמן
5.]ל◦◦◦[[

1.] And (the) Lights
2.]their [ ], in their *mazalot*
3.]their [ ] in all the appointed times
4.]all of them. Amen. Amen.
5.]*l* [ ]◦◦◦

In terms of a zodiac calendar, such an order would make sense given that Gen 1.14 omits the stars for determination of the appointed times.

The editor of the critical edition, Bilhah Nitzan notes of line 2, "The term מזלות, *mazalot* refers to the signs of the zodiac used for astrological purposes."[234] It may be argued that if the text did not wish to leave this question open, the noun כוכבים "stars" may have been used in line 2 instead, thereby making a direct connection to Genesis 1:14, 16. The use of the term מזלות, *mazalot* draws

232 Zatelli, "Astrology and the Worship of Stars in the Bible," 94–95.

233 B. Nitzan, "287. 4QBerakhotb," DJD 11, 50.

234 Nitzan, "287," DJD 3, 51.

attention to the fact that the "stars" of Genesis 1:16 have been replaced in the text by the *mazalot*. From a literary perspective, this is good poetic practice, no work of literature reuses the same vocabulary repeatedly, yet since the two plural entities co-exist in *The Genesis Apocryphon* (discussed above) and are not merely synonyms Nitzan's observation should be taken on board.

The Fourth Day: 4Q216 (*4QJub*[a]) col. vi, lines 5

One Hebrew literary source which arguably rejects the luni-solar calendar is *Jub*. 2:8–9 = 4Q216 (4QJub[a]) vi 5–8 (mostly reconstructed),[235] a rewriting of the fourth day of Creation, Gen 1: 14, in which only the sun has dominion over cult-defined periods of time and the calendar.

VanderKam comments that the correspondence between the Hebrew version in the Dead Sea Scrolls and the "complete and much later" Ethiopic manuscript shows that "the text of the book has been preserved with great care across the centuries."[236]

4Q216 (4QJub[a]) col. vi, lines 5–10[237]

5. *Jub.* 2:8 On the fourth day the Lord made the s]un, the moon, and the stars. [He placed]

6. [them in the firmament of the heavens to shed light over the whole earth,] to rule over the day and the night, and to sep[arate between]

7. [light and darkness. *Jub.* 2:9 He appointed the sun as a gre]at [sign above the earth] for day[s], for [sa]bbaths, for [months,]

8. [for festivals, for years, for the weeks of years, for jubi]lees, and for all the cy[cles of the years.]

9. [*Jub.* 2:10 It separates between the light and the darkness and serves for healing so that everything that] sprouts and grows on the ea[rth may be well.]

10. [These three types he made on the fourth day. *va*]*cat*

It is argued that the pericope may reflect an anti-lunar calendrical polemic expounded in the Ethiopic *Jub*. 6:23–38.[238] Although the definition of the "months" ([חדשים]וֹל, *Jub*. 2:9, 4Q216 col. vi line 7) is subject to interpretation,

235 VanderKam and Milik, DJD 13, 16–17 (pls. 1–2).

236 VanderKam, *The Book of Jubilees* (CSCO 511; Leuven: Peeters, 1989), Introduction, xi.

237 Translation: M. Abegg and M.O. Wise in *The Dead Sea Scrolls: A New Translation*, 320.

238 J.C. VanderKam, *The Book of Jubilees* (Guides to Apocrypha and Pseudepigrapha; Sheffield: Sheffield Academic Press, 2001), 29; idem, "The Origins and Purposes of the Book of Jubilees," in *Studies in the Book of Jubilees*, 16–18. See also E.J.C. Tigchelaar, " 'Lights Serving

the moon and stars are created with the sun, they are not ignored. However, neither are they given a calendrical role. Ravid notes that the months are emphasised throughout *Jubilees* and she takes issue with the consensus interpretation that *Jub.* 2.9 (4Q216 frags 14–17 (= iv) lines 7–9)[239] is a reference to a solar calendar:

> It seems a great sign above the earth for days, Sabbaths, months, festivals, years, Sabbaths of years, jubilees, and all times of the years (*Jub.* 2.9), has nothing to do with the solar calendar. It simply interprets the text of Genesis: God said, 'Let there be lights in the expanse of the sky to separate day from night; they shall serve as signs for the set times—the days and the years—' (Gen 1:14).[240]

One may add that *Jub.* 2:8 (4Q216 frags 14–17 (= col. iv) line 5)[241] interprets Gen 1:16, to make the point that the stars work together with the sun and moon in Gen 1:14–16. "The stars" according to the syntax of Gen 1:16 may be interpreted as being a gloss:

> And God made two great lights; the big light to rule the day, and the small light to rule the night; and the stars[242]

Westermann discusses and considers whether "Lights," מארות in Gen 1:14, which are not numerated and have no definite article, include the stars as well, or if the stars are the separate entities. The first mention of the luminaries does not define what they are:

> . . . מארות, Lights in the vault of the heavens that divide the day from the night; and they will be for signs and for seasons, and for days and for years (Gen 1:14)[243]

He concludes that מארות, "Lights" includes the stars and that the creation of the universe (with the stars) originally belonged to a different account of

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as Signs for Festivals' (Genesis 1:14B)" in *The Creation of Heaven and Earth* (ed. George van Kooten; Leiden: Brill, 2004), 39–41.

239 VanderKam and Milik, DJD 13, 16–17.

240 L. Ravid, "The Book of Jubilees and its Calendar—A Re-Examination," *DSD* 10.3 (2003): 380.

241 VanderKam and Milik, DJD 13, 16–17.

242 Gen 1:16. (My translation).

243 Gen 1:14. (My translation).

the creation of the sun and moon.[244] The fourth day of Creation in *Jub*. 2:8 (4Q216 col. iv lines 5–8) brings the stars into an equal partnership with the sun and moon.

Interestingly, this Creation theme is quite dissimilar from *Jub*. 8:2–5 (extant in Ethiopic only) in which the sun, moon and stars have a calendrical and astrological function, but it is hidden knowledge. In this story, teachings pertaining to "the omens of the sun, moon and stars and every heavenly sign" had been transmitted across time by the Watchers from before the Flood by the means of inscriptional writing on rock. It was discovered by a great-grandson of Noah, Cainan, who was punished because he was not divinely authorised to receive it.[245] Thus, there is the question of whether there is a sub-text in the Ethiopic book of *Jubilees* that the meteorological function of the sun, the moon and for the stars—for signs, for seasons, for days and for years outlined in Gen 1:14b—is not intended for everyone in each generation to understand, but a chosen, authorised few.

Instruction to Enoch. 4Q227 *4QPseudo-Jubilees*^{c}?[246] Frag 2, *Jub*. 4.17–18 and Related Texts

The reference to the months in 4Q227 frag. 2 lines 4–5 implicitly refers to the moon since it is connected with the paths of the stars. The context is the authorised angelic knowledge about the astronomical calendar taught to Enoch so that festivals could be celebrated at the correct time:

4Q227 frag 2, lines 4–5

4 ויכתוב את כול.....
5 [...ש]מים ואת דרכי צבאם ואת[החוד]שים

4 .....And he wrote everything
5 [...of the he]avens and the paths of their armies and [the mon]ths
(6. s]o that the r[ighteous] (would not err) [uncertain])[247]

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244 C. Westermann, *Genesis 1–11: A Continental Commentary* (Minneapolis, MN: Augsburg, 1984), 129–133 (esp. 131).

245 Translation: Vanderkam, "The Book of Jubilees," (1989), 50–51. Discussed in H.R. Jacobus, "The Curse of Cainan (*Jub*. 8.1–5): Genealogies in Genesis 5 and Genesis 11 and a Mathematical Pattern," *JSP* 18.3 (2009): 207–232.

246 VanderKam and Milik, DJD 13, 173–175, pl. 12. Milik, *BE*, 12, 25.

247 Trans: *DSSSE* 482–483. VanderKam and Milik's translation of 4Q227 2 4–6:] 4..... And he wrote all 5. the sky and the paths of their host and the [mon]ths 6. S]o that the ri[ghteous] (should not err)? DJD 74; cf, Milik, *BE*, 12, translates "its hosts" instead of "their armies."

If "paths of their armies and [the mon]ths" (line 5) refer to the role of the moon and stars, then that would be a different calendar from that in *Jub.* 2:8–9 = 4Q216 (4QJub[a]) col. vi lines 5–8. There is an echo in this story of the angel Uriel revealing calendrical and astronomical information to Enoch in the Ethiopic *1 En.* 80:1 and of Enoch passing the lesson to his son, Methuselah, in *1 En.* 82:1, 7–8, 9–10.[248] In *1 En.* 80:1, Uriel shows Enoch "everything" suggesting a possible relationship between the development of the final Ethiopic text and 4Q227 2 4 (Heb) or Genesis Apocryphon (1QapGen ar) ii 20–21a.[249] The other similarities involve the imagery of the cosmos containing the sun and moon, yet focusing on the moving wheel of stars dipping and rising, below and above, the horizon:

> *1 En.* 80:1
> At that time Uriel the angel responded to me: "Enoch, I have now shown you everything, and I have revealed everything to you so that you may see this sun and this moon and those who lead the stars of the sky and all those who turn them—their work, their times, and their emergences.[250]

The question of the importance of the stars setting in their months at the correct times on their festivals is emphasised in *1 En.* 82:9–10 as a prelude to the list of the names of angels who lead the stars in 360-day years (*1 En.* 82:11, and 4Q209 frag 28),[251] the same number of degrees in the zodiac. As the sun moves at about one degree each day, the text may be describing a solar zodiacal year.[252]

The term צבא השמים "host of heaven" with specific reference to the stars of heaven, occurs 19 times in the Bible and once in *Ben Sira* 43: 9 (8), Zatelli, "Astrology and the Worship of Stars in the Bible," 90; also see Gen 2:1.

248 Vanderkam thinks that the author of *Jub.* 4.17 knew the Aramaic Astronomical Book (unspecified manuscripts), placing the Qumran text to before c. 160–150 B.C.E., the date he estimates that *Jubilees* was authored, *1 Enoch 2*, 344–345 and see references to the discussion at n. 52; for the date of *Jubilees*, see VanderKam, *The Book of Jubilees* (1981), 17–21. Machiela agrees with this date for *Jubilees*, see Machiela, *The Dead Sea Genesis Apocryphon*, 15–16. VanderKam adds that 4Q277 frag 2, line 2, "six jubilees of years," is 294 years, a chronological unit in the calendrical texts from Qumran, in VanderKam, *1 Enoch 2*, 541–542. VanderKam allows for the possibility that *1 En.* 80:1 may be a later addition, *1 Enoch 2*, 345, 523.

249 See also The Skills of the Descending Angels, §2.4.1.

250 VanderKam, *1 Enoch 2*, translation, 521; commentary, 522–523.

251 Vanderkam, *1 Enoch 2*, translation: 555; commentary: 557–561; Drawnel, *The Aramaic Astronomical Book*, 198–200 (also in Chapter 3).

252 This concept runs through Chapters 1–4.

The noun "hosts" or "armies" צבא, referring to the stars, appears with frequency in the Dead Sea Scrolls.[253] Few references are concerned with the calendar, however. They are divided between using the "host of heaven" as a phrase in connection with forbidding the worship of the stars, probably based on Deut 4:19–20[254] and those using the term in connection with revealed knowledge, particularly so in *4QInstruction*[b] (4Q416).[255]

The text 4Q227 frag 2, lines 4–5 appears to allude to *Jub*. 4:17–19a, 21c, according to which Enoch was the first man to record revealed astronomical knowledge and wrote down that which the angels showed him. The very meagre possible remains of *Jub*. 4:17–18? = *11QJubilees* (11Q12) frags 3–4 have been reconstructed as:

1. [And he wrote down in a book the signs of the sky, according to the order of their months, so tha]t [the sons of men] would know
2. [the cycles of the years, according to the orders of all their months. *Jub.* 4:18 He was the [fir]st
3. [to write a testimony, and he testified to the sons of men in the generations of the earth. The weeks of] the [Jubilees].[256]

In his 1902 translation from the Ethiopic, *Jub*. 4:17–18, Charles interprets the phrase the "signs of heaven according to the order of their months" in a note as referring to the correspondence of solar months with the signs of the zodiac. [257] VanderKam's translation from the Ethiopic manuscripts is similar to Charles's.

253 About 26 extant and part-restored instances (*DSSEL*).

254 S. Olyan, *4Qpap paraphrase of Kings* et al. (4Q382) frag 9 line 4, in DJD 13, 368–369; Y. Yadin, *11QTemple*[a] (11Q19) col. lv line 18 in (*The Temple Scroll*, London: Weidenfeld and Nicolson, 1985), *DSSSE* 1276–1277; Wise, "The Temple Scroll (11Q19–21, 4Q524, 4Q365a)," *The Dead Sea Scrolls: A New Translation*, 623.

255 For example, J. Strugnell and D.J. Harrington, *4QInstruction*[b] (4Q416) frag 1, lines 4–7, DJD 34, 81–83.

256 *Jub*. 4:16–18?=11Q12 frags 3–4 (very fragmentary), see F. García Martínez and A.S. van der Woude, "11Q12 Jubilees," DJD 23, 213, pl. 26. They state the passage cannot be reconstructed with certainty.

257 *Jub*. 4:17 "he called his name Enoch. And he the first among men that are born on earth who learnt writing and knowledge and who wrote down the signs of heaven according to the order of their months in a book, that men might know the season of the year according to the order of (18) their separate months". R.H. Charles, *The Book of Jubilees* or *The Little Genesis* (London: Adam and Charles Black, 1902), 37 and n. to v. 4:17: *Signs of heaven*

> Jub.4.17 He was the first of mankind who were born on earth who learned the (art of) writing, instruction, and wisdom and who wrote down in a book the signs of the sky in accord with the fixed pattern of their months so that mankind would know the seasons of the years according to the fixed patterns of each of their months.[258]

VanderKam points out that a citation in the Syriac Chronicle, accepted by scholars to be independent of a Greek *Vorlage* unlike the Ethiopic manuscripts,[259] omits the phrase "in accord with the fixed pattern of the their months" and has a different expression for the seasons of the years: "the changes of the times and of the years" (see below).[260] K. Berger's German translation from the Syriac (also below) agrees with VanderKam's.

> Jub. 4.17a Dieser nun lernte als erster Schreiben und Wissenschaft und Weisheit von den Menschen, von denen, die geboren auf Erden. Jub. 4.17b Und er schreib die Zeichen des Himmels nach der Ordung ihrer Monate in ein Buch, damit die Menschenkinder der Zeit der Jahre wüssten nach ihren Ordnungen nach ihren Monaten.[261]

> Syriac Chronicle (39.1–8)
> Dieser Henoch lernte als erster das Schreiben und die Lehre und die Weisheit. Und er schrieb die Zeichen des Himmels in ein Buch, zu lehren die Menschen die Veränderungen der Zeiten und der Jahre nach ihren Regeln und nach ihren Monaten (cf. 1 En. 72:1).[262]

> Syriac Chronicle (39.1–8)
> Jub. 4.17 This Enoch was the first to learn (the art of) writing, instruction, and wisdom. And he wrote down in a book the signs of the sky to inform

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according to the order of their months. The twelve solar months correspond to the twelve signs of the Zodiac.

258 VanderKam, *Book of Jubilees* (1989), 25–26.

259 VanderKam, *Book of Jubilees* (1989), Introduction, xiv–xvi and n. 35 for bibliographic details.

260 VanderKam, *Book of Jubilees* (1989), 26. On p. xvi VanderKam states that the Syriac Chronicle citations are "much closer in nearly all cases to the text of Jubilees than are the Greek excerpts."

261 K. Berger, *Das Buch der Jubiläen* (JSHRZ II.3; Gütersloh:Gütersloher Verlagshaus, 1981), 343.

262 Berger, *Das Buch der Jubiläen*, 343–344.

> mankind about the changes of the times and of the years according to their fixed patterns and according to their months.[263]

Berger comments that the phrase, "Zeichen des Himmels" is a reference to astrology.[264] In contrast, VanderKam does not comment on the explanation offered by both Charles and Berger that the "signs of the sky" in *Jub*. 4.17 refers to the zodiac signs. From our point of view, the reference to the signs of the sky written according to their months in a book in a fixed pattern could describe a zodiac calendar and that *4QZodiac Calendar* and the synchronistic calendar of 4Q208–4Q209 to be explored in Chapter 3 may be angelic astronomical books connected to *Jub*. 4.17.

Abram's Practice of Weather Astrology (11QJubilees and *Jub*. 12:16–20)

This pericope may indicate that there is no contradiction between a Jubilees-Qumran calendar co-existing with an Aramaic luni-solar-stellar calendar. *Jub*. 12: 15b–17 = 11QJubilees (11Q12)+XQ5a frag 8, lines 2–6, constitutes the very fragmentary remains of the narrative of Abram observing the stars on the first day of the seventh month to see what kind of year lay ahead with respect to rainfall. The scene takes place while Abram is in Harran with his father Terah, Sarai, Nahor and Lot (*Jub*. 12:15; Josh 24: 2–3; Gen 11:31–2).[265] Abram is geographically, psychologically and emotionally inbetween Ur of the Chaldees and leaving his father to start a new nation in Canaan. In the previous scene, Abram's brother, Haran, died in front of his Terah (Gen 11:28) trying save idols from a fire, the result of an arson attack perpetrated by Abram (*Jub*. 12:12–14, not in the Bible). In *Jub*. 12:16–20, Abram is sitting alone in Harran observing the stars (either in a watch, or with calculations) when he realises: "All the signs of stars and the signs of the sun and moon are in the hand of the Lord. Why am I seeking?"[266]

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263 VanderKam, *Book of Jubilees* (1989), 332. (It may be argued that the omission of "in accord with the fixed pattern of their months" was excised in the Syriac Chronicle because the phrase may have seemed to be duplicated, appearing once after "the signs of the sky," and again in a similar fashion after "the seasons of the years.")

264 Berger, *Das Buch der Jubiläen*, 343, n.d.

265 Abram's name was not changed to Abraham until after the birth of Ishmael in the Bible (*Jub*. 15:7; Gen 17:5).

266 Wintermute, "Jubilees," 81.

11Q12 frag 8 lines 2–6 (=Jub. 12:16–17)[267]

. . . . . [16]And in the sixth week]
3. in [its] fifth (year) [Abram sat down during the night of the first day of the seventh month to observe]
4. the star[s from the evening to the morning to see what would be the nature of the year in relation to the rains. And it happened that]
5. while he[was sitting alone and observing, [17] a voice came to his heart and said: 'All the signs]
6. of the sta[rs]

It seems possible that Abram was casting an astrological chart, rather than physically observing the stars. It is an established astrological practice in India today for an astrologer to cast a horoscope for the position of the new moon (lunar conjunction) before the vernal (spring) equinox—the astrological New Year—to predict whether there will be rain in the year ahead. The diffusion of Babylonian astronomy eastwards to India is well-documented but the transmission of astrological practice is an underdeveloped area of research.[268] The method of astrological weather forecasting may be described in *Jub*. 12:16 and the fact that this practice exists in Indian astrology may indicate that this is a Babylonian tradition to which Indian astrology is witness and where it has survived. Meteorological astrology was a popular and well-known practice in Greece; Ptolemy (second century C.E.) described the practice of casting a chart for the new moon at each of the solstices (summer, winter) and equinoxes (spring, autumn) in order to predict the weather for the season following.[269]

Alternatively, Abraham could have been observing the rising of the stars for indications of the weather, a practice described in detail by Aratus, Geminos and Hesiod.[270] However, *Jub.* 12:16–20 appears to indicate that an element of

267 *DSSEL*; Abegg and Wise, "The Book of Jubilees," *The Dead Sea Scrolls: New Translation*, 323; F. Garcia Martínez and A.S. van der Woude, "11Q12 Jubilees," DJD 23, 216–217, pl. 26: VanderKam, *The Book of Jubilees* (1989), 71.

268 K. Sutton, British Association of Vedic Astrology, oral communication. On the dissemination from Babylon to India, see D. Pingree, "Legacies in Astronomy and Celestial Omens," in *The Legacy of Mesopotamia* (ed. S. Dalley; Oxford: OUP, 1998), 127–128; also for the practice of casting a chart for the vernal equinox: D. Pingree, "Astrology in India and Iran," *Isis* 54 (1963): 229–233, 242, 243, 245; O. Neugebauer, *HAMA*, 6–7.

269 Ptolemy, *Tetrabiblos* II.10–13 (Robbins, LCL), 195–219.

270 Evans and Berggren, *Geminos's Introduction to the Phenomena*, 217–226.

divination was involved and that Abram rejected this practice, concluding that the stars are under God's control.[271]

The link between the stars and the calendar are highlighted in this text. The date of the first day of the seventh month (*Jub*. 12:16) in the Dead Sea Scrolls is the Day of Remembrance/Remembrance of Trumpets (I/VII) as it is in the Bible (Lev 23:23), not New Year's Day (1/I).[272] The biblical first month of the year is also in the spring (Exod 12:2). It is interesting to consider the origin and significance of that date in *Jubilees*, and whether the first day of the seventh month is meant to refer to the New Year. If the signs of stars and the sun and moon (*Jub*. 12:17; in that order) refer to the zodiac signs, the authors of *Jubilees* may have known the Aramaic zodiac calendars. In the *Jubilees* story, it appears that Abram was a well-known astrologer and he consults God as to whether to return to Ur where his skills are missed (*Jub*. 12.21):

> *Jub.12: 21*:
> and he said, shall I return to Ur of the Chaldees who seek my face so that I should return? Or should I dwell here in this place? . . .[273]

There seems to be an intellectual difference between Abraham's rejection of the practice of astrology and Enoch's initiation into the skills of astronomy, astrology and calendars. Abraham as a teacher of astrology was the theme of a popular narrative from antiquity until the medieval period, and his Chaldean background (a synonym for being versed in astrology) was an important element in this story.[274]

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271 Abram's new religious philosophy in *Jub.* 12:16–20 is possibly referenced by Josephus in *Ant.* 1.156, *Flavius Josephus, Judean Antiquities 1–4* , Translation and Commentary by L.H. Feldman, edited by S. Mason (Leiden: Brill, 2000), 57–58 nn.502, 503, 504.

272 Talmon, DJD 21, Appendix 1, p. 15, calendars of the priestly course, *mišmarot*, dates in texts: I/VII: 4Q321 v 6, 75–76; 4Q321 vi 1, 77–78; I/I: 4Q321 iv 8, pp. 74–75; 11Q19 (*11QTemple Scroll*[a]) xiv 7–10, see *DSSSE* 1234–1235.

273 Wintermute, "Jubilees," 81.

274 The second-century C.E. Hellenistic astrologer Vettius Valens lists Abraham as one of the earliest astrologers (*Astrologiae* 2.28–29 [see Valens, "Anthology," ed. Pingree]). As received by Eusebius, the second-century B.C.E. historians Artapanus of Alexandria and Pseudo-Eupolemus wrote that Abraham taught astrology to the Egyptians, the latter claiming that he learned it from Enoch. Artapanus (c. second century B.C.E.) in his *Judaica*, in Eusebius, *Praeparatio Evangelica*, 9.18.1, see *Praeparatio Evangelica* (Preparation for the Gospel), trans. and ed. E.H. Gifford (Oxford, OUP, 1903), 420a; "The Fragments of Artapanus," (*PrEv* Fragment 1, 9.18.1), trans. J.J. Collins, in Charlesworth, *OTP*, 2.897 and background, 2.889; Eusebius, *Praeparatio Evangelica* (ref. Enoch) 9.17.3,

4Q88 (4QPsalms[f]) *Apostrophe to Judah* Col. x Lines 5–6.[275]

The strophe advances a clear description of human and angelic prayer; in which the stars possibly represent heavenly beings.

4Q88 col. x lines 5–6

5. ... אז יהללו שמים וארץ
6. יחד יהללו נא כל כוכבי נשף

5. Then the heavens and earth will praise
6. Together. Let all the stars of twilight praise

Praising on earth with angels at dusk when the stars appear suggests that the aim of this liturgy is to have unity between heaven and earth so that the angels can hear human prayers. One may argue that this must happen when the time is right, when the heavens are connected to people on earth and that therefore a calendar consisting of the sun, moon and stars would inform humans of the proper time to praise in unity with the stars. There is a textual connection between 4Q88 col. x lines 5–6 and Job 38:7: "When the stars of the morning

in Gifford (1903), 418; *PrEv* 9.17.2–9, 9.18.2, trans. Doran, in Charlesworth, *OTP*, 2. 880–882 and textual background to Abraham and astrology (Abraham tracing his lineage to the giants) "Pseudo-Eupolemus," in ibid., 2. 873–879; B.-Z. Wacholder, *Eupolemus: A Study of Judaeo-Greek Literature* (Cincinnati, OH: HUC, 1974), 288, 313–314. Josephus also claimed that Abraham taught astronomy to the Egyptians. These are expansions of a narrative in Gen 12 in which Abram leaves Harran and goes down to Egypt with Sarai. Josephus. *Ant.* 1.158, 166–168 (Thackeray, LCL); *Josephus, Ant. 1–4* (Feldman-Mason), 59, esp. n. 509, 63–64, esp. n. 538; Philo: *Abr.* 15.68–72 (Colson, LCL); *Ques. Gen.* 3.1 (Marcus, LCL); *Migr.* 32 (177)–36 (197) (Colson and Whittaker, LCL); A.Y. Reed, "Abraham as Chaldean Scientist and Father of the Jews: Josephus, Ant. 1.154–168, and the Greco-Roman Discourse about Astronomy/Astrology," JSJ 35 (2004): 119–158; also see VanderKam, *1 Enoch* 2, 343 and nn. 46, 47; W. Adler, "Abraham's Refutation of Astrology: An Excerpt from Pseudo-Clement in the Chronicon of George the Monk," in *Things Revealed: Studies in Jewish and Christian Literature in Honor of Michael E. Stone* (ed. E.G. Chazon et al.; SJSJ 89; Leiden: Brill, 2004), 227–242; W. Adler "Did the Biblical Patriarchs Practice Astrology? Michael Glykas and Manuel Komnenos I on Seth and Abraham," in *The Occult Sciences in Byzantium* (ed. P. Magdalino and M.V. Mavroudi; Geneva: La Pomme d'or, 2006), 245–263; J.E. Taylor, *The Essenes, the Scrolls and the Dead Sea* (Oxford: OUP, 2012), 335; S.L. Sanders, "I Was Shown Another Calculation" (חשבון אחרן אחזית): the Language of Knowledge in Aramaic Enoch and Priestly Hebrew," Appendix in *Ancient Jewish Sciences*, ed. J. Ben-Dov and S.L. Sanders. Cited February 4 2014. http://dlib.nyu.edu/awdl.isaw/ancient-jewish-sciences/.

275 P.W. Skehan et al., "4QPsf (4Q88)," *Qumran Cave 4.11*; DJD 16 (2000), 85–106; *DSSSE* 280–281.

sang together and all the sons of God shouted for joy,"[276] and *11QTargum of Job* (11Q10 or 11QtgJob) col. xxx lines 4–5:

> 4. . . when 5 the stars of the morning shone together, and all the angels of God cheered together(?)[277]

The specific literary *topos* is that humankind and the angels can praise together at the pilgrim festivals (4Q88 col. × line 9a). The angels are animations of the stars, hence the host, or armies of heaven. Therefore, a calendar with a stellar element is required in order for the human congregation to align with the angel-stars at the correct time in order that the prayers from earth, rising through a celestial alignment to heaven, can reach God.

4Q502 Ritual of Marriage frag 27, lines 1–4

1 [. . .]רוהי עולמים . . . 2 [. . .] . . . משרתי]ם לכה תמיד ע[רב ובוקר [. . .]
3 [. . .] עם כול דגלי יר[חהם . . .] 4 [. . .] עם כוכב[י השמים [. . .

> 1 [. . .] eternal spirits . . . [. . .] 2 who serve] you continuously (in the) ev]ening and morning [. . .]
> 3 [. . .] with all the signs of (their) mo[nths . . . 4 [. . .] with the star[s of the heaven . . .][278]

Scholars generally agree on linguistic grounds that 4Q502 is a sectarian text, but disagree as to its purpose: a marriage ritual (Baillet, Falk), a celebration of old age (Baumgarten), a New Year Ritual for Nisan 1st (Satlow) or an Initiation ceremony (Cook, also favoured by Arnold).[279] If the text is sectarian, lines

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276 The concept of the heavenly host as a synonym for angels in the Bible has been extended by E. Chazon to include certain Dead Sea Scrolls: 4Q503 *Daily Prayers*, 4Q400–407, 11Q17 *Songs of the Sabbath Sacrific*e, and 4QBer[a–b] *Berakhot.*, see "Liturgical Communion," 95–105. On the angelic liturgy, B. Nitzan cites *Jub* 2:3; 11QPs[a] 26:9–15, Sir 42:16–17, see "The Idea of Creation and Its Implications in Qumran Literature," in *Creation in Jewish and Christian Tradition* (ed. Graf Reventlow and Hoffman), 257.

277 *DSSSE* 1196–1197; F. García Martínez, E.J.C. Tigchelaar and A.S. Woude, *Qumran Cave 11: II, 11Q2–18, 11Q20–31*, DJD 23 (1998), 149–150.

278 Trans. *DSSSE* 996–997; Baillet translated: (1) les ésprits éternels (2). Te [servan]t en permanence [s]oir et matin (3) . . . . avec toutes les troupe des mo[is] (4).avec les étoile[s du ciel . . .], DJD 7, 90.

279 Baillet, DJD 7, 89–90; J.M. Baumgarten, "4Q502, Marriage of Golden Age Ritual?" *JJS* 34 (1983): 125–135; M.L. Satlow, "4Q502 A New Year Festival?" *DSD* 5.1 (1998): 57–68; Falk, *Daily,*

3–4 suggest that a Jewish group had an interest in the stars and lunar months. However, it may be argued that there is nothing politically or theologically ideological about such knowledge and that if a particular Jewish sect knew of such a in this cosmological scheme it could be a reflection of the belief system in Second Temple Judaism.

There is an echo between 4Q502 frag 27, lines 3–4 and 4Q227 *4QPseudo-Jubilees*[c]*?* frag 2, line 5 (see pp. 36–38) by the hint that there is a working relationship between the months and the stars. The phrase דגלי יר[חהם "signs of their months" is intriguing, and in the light of the Aramaic zodiac calendar explored in this study could be construed to mean the zodiac signs. Baillet made a similar remark, suggesting that the term דגל or "troop" applied to particular angels in rabbinic literature, and he asked whether here the term applied to groups of stars that marked the months.[280] The hypothesis that there are different kinds of terminology in the Dead Sea Scrolls to refer to the a calendar linked to stars and signs in some form is discussed further, below.

Thanksgiving Psalms. (1QHodayot-[a] Col. ix Lines 9–22 and Col. xx Lines 7–14)

The references to the luminaries in the strophes comprising 1QH[a] col. ix lines 9–22[281] describe cosmic time, not temporal time that can be measured on earth, nor the fixed, schematic calendar. Of relevance from this section to the *4QZodiac Calendar* are elements of the Thanksgiving Psalms that highlight the interaction between time measurement and the heavenly bodies. 1QH[a] col. ix lines 13–14:

1QHa (*Thanksgiving Psalms*) *col. ix lines 13–14*:

13 מאורות לרזיהם
14 כוכבים לנתיבות̊י̊[הם

Sabbath and Festival Prayers, 24–25; Arnold, *Social Role*, 53; Cook, *Dead Sea Scrolls: A New Translation*, 518–519.

280 Baillet, DJD 7, 90: " 'troupe' s'applique en particulier aux anges dans la littérature rabbinque (Jastrow, 280), s'agit-il donc ici des groupes d'étoiles qui marquent les mois?"

281 Critical edition: C.A. Newsom (trans.), H. Stegemann, E.M. Schuller., DJD 40, 118 (Heb.), 139 (trans.), pl. 7; E.M. Schuller and C.A. Newsom, *The Hodayot* (*Thanksgiving Psalms*): *A Study Edition of 1QH*[a] (EJL 36; Atlanta: SBL, 2012), 30–31; C.A. Newsom, *The Self as Symbolic Space* (STDJ 52; Leiden: Brill, 2004), 222–4, 226. Cf.: 1QH[a] ix 21–22, 1QH[a] xx 12–14; *4QInstruction*[d] (4Q418) frag 123, col. ii lines 3–4, see M. Goff "The Mystery of Creation in 4QInstruction," *DSD* 10.2 (2003): 163–186 (esp. 168).

13 ..... luminaries for their mysteries,
14 stars according to [their] paths

Below, is a full translation of this section of the hymn in order to place this discussion within its literary and cosmological context.

1QHa (Thanksgiving Palms) ix 9–22 translation[282]

9. By You[r] wisdom [You have]e[stablish]ed the successive [generations] and before You created them You knew {all} their works 10 for ever and ever. [For apart from You no]thing is done, and without Your will nothing is known. You have formed 11. every spirit and [Yo]u[determined its] de[eds] and judgement for all their works. *vacat* You have stretched out the heavens 12. for Your glory, You [formed] all [their hosts] according to Your will, and the powerful spirits according to their laws, before 13. they became [Your]h[oly] angels [ ], as eternal spirits in their dominions, luminaries for their mysteries, 14. stars according to [their] paths, [and all the storm winds] according to their duty, meteors and lightning bolts according to their service, and the storehouses 15. designed for the[ir] needs [ ]for their secrets. *vacat* You have created the earth with Your strength,16. seas and deeps [ ] their [ ] You have determined in Your wisdom, and all that is in them 17. You have de[t]ermined according to You[r] will. [You appointed them] for the spirit of man whom You have formed upon the earth, for all the days of eternity 18. and the everlasting generations in accordance with [their] w[orks] in their ordained seasons. You apportioned their service in all their generations and judgem[en]t 19.for its appointed times for their domini[on of] their [ ] for successive generations and judgement for their retribution as well as 20. as well as> all their punishments. [ ] You have apportioned it to all their offspring according to the number of everlasting generations 21. and for all the years of eternity [ ] and in the wisdom of Your knowledge You det[e]rmined their de[s]tiny before 22. they came into existence and according [to Your]w[ill] everything [c]omes [to pass], and nothing happens apart from You. *vacat*

The powerful poetry incorporates references to the sun, moon and stars, meteorological phenomena and angels, woven into a paean to Time itself.

282 Translation by M.G. Abegg in *DSSEL* (2006), s.v. 1QH[a] (the verse numbering has been changed to accord with that of Schuller and Newsom, *The Hodayot*, 31.

Heavenly time is intertwined with the concept of preordained destiny, birth, the continuum of past, present, future, eternity and the end of time which is neither linear, nor circular, but is in the hand of the divine.

The motif of stars in their paths is a known cosmological motif in ancient Near East literature. In variant prologues to *Enūma Anu Enlil,* the three "great gods," Anu, Enlil and Ea explicitly organise the calendar: night, day, month and year in their arrangement of the constellations, and the paths of the sun and moon (*EAE* tablet 22 1–7).[283]

> [1.] When Anu, Enlil, and Ea, the great gods, [2.] heaven and earth built, fixed the astronomical signs; [3.] established the stellar positions, [se]t fast the stellar-locations; [4.] the gods of the night they [...] ..., divided the paths; [5.] the stars, the likenesses [of them they dr]ew, the constellatio[ns;] [6.] night (and) day, as equa[ls? they measure]d, month and year they created; [7.] for Sin and Shamash, ... [... the decisions of heave]n and earth they (Anu, Enlil, and Ea) determined.[284]

Hence, in the Babylonian Creation myths, Marduk assigns Anu, Enlil and Ea to three parts of the heavens where they organise the stars and constellations to establish the night, the months and the years. In *The Exaltation of Ishtar*: 25–30, Anu, Enlil and Ea appoint the Moon-god and Sun-god ...:

> [29] to keep all the stars in a place as in a furrow/ [30.] to make the gods at the fore keep to the path like oxen.[285]

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283 F. Rochberg, *Aspects of Celestial Divination: The Lunar Eclipse Tablets of Enūma Anu Enlil* (AfOS 22: Horn: F. Berger & Söhne, 1988), 270–271, Source E only, numbering: 14–20; Horowitz, *Mesopotamian Cosmic Geography*, 146–148 nn. 56, 57 for bibliography.

284 Horowitz, *Mesopotamian Cosmic Geography*, 146–147. Cf. D. Brown *Mesopotamian Planetary Astronomy-Astrology* [*MPAA*] (Groningen: Styx, 2000), 254–255 (he states that it is a late copy of *EAE* Tablet 22): "When Anu, Enlil and Ea, the great gods, created heaven and the earth, fixed the signs, established stations, founded positions, [appointed] the gods of the night, divided the (star)-paths, designed the constellations, the patterns of the stars, divided night from daylight, [measured] the month and created the year; for Moon and Sun ... they determined the decisions of heaven and earth." Tablets: K5981 and K11867. Cf. close parallels with the earlier Akkadian and Sumerian versions of this text (Brown, *MPAA*, 255).

285 *The Exaltation of Ištar* known from two Late Babylonian tablets from the Temple of Reš, Uruk (edition: B. Hruška, *ArOr* 37.4 {1969}, 473–522), English trans: Horowitz, *Mesopotamian Cosmic Geography*, 144–145; See also ibid., 114–117, 146–148, 267.

Astronomical understanding is needed for calendrical precision and the accurate measurement of temporal time against heavenly time provided by the luminaries. The psalm in another column from the Thanksgiving Psalms, 1QH[a] col. xx lines 7–14, uses the conceit of astronomy and man-made organisation of time to describe a stepped hierarchy of time, from sunset to the end of time, created by divine astronomical rules:

1QHa xx 7–14[286]

7 למשכי]לֹ[ה]וֹדותֹ ותפלה ל֗התנפ֗ל והתחנן תמיד מקצ לקצ עם מבוא אור
8 לֹ֗ממשֹ[לתו]בתקופות יום לתכונו לחוקות מאור גדול בפנות ערב ומוצא
9 אור ברשית ממשלת חושך למועד לילה בתקופתו לפ֗נות בוקר ובקצ
10 הֹ֗אספו אלמ֗ונתו מפני {תֹ} אור למוצא לילה ומבוא יֹומם תמיד בכול
11 מולדי עת יסודי קצ ותקופת מועדים בתכונם באותותם לכול
12 ממשלתם בתכון נאמנה מפי אל ותעודת הווה והיאה תהיה
13 ואין אפס וזולתה לוא היה ולוא יהיה עוד כי אל ה{ו}ד{י} עות
14 הכינה ואין אחד עמו

7 [For the instruct]or, [th]anksgiving and prayer for prostrating oneself and supplicating continually at all times: with the setting of Light[287] 8 for [its] domin[ion]; at the turning points of the Day to its arrangement according to the statutes of the Great Light; when it turns to Evening and 9 Light goes forth at the beginning of the dominion of Darkness at the specified time appointed for the Night; at its turning point, toward the Morning; and at the time that 10 it is gathered in to its dwelling place before Light appears, to the departure of Night and the entering of eternal days in all 11 births of time, the foundations of periods of time, and the solstices and equinoxes of seasons/festivals, each to the arrangement of their signs 12 from their dominion in the order faithfully, from the command of God. And it is a testimony to that which exists and will be,[13] and apart from it there is nothing that shall be. It shall not be and it shall not be evermore. For the God of kn(o)(w)ledge 14 has established it and there is none other with him.

The order begins with the divisions of the day with the repeated use of a metaphor identifying solstices and equinoxes, the *tequfot*, with four parts of

286 DJD 40, 250 (Heb.), 259 (translation adapted by this author), pl. 18; Schuller and Newsom, *The Hodayot*, 62–63.

287 Cf. Ps 104: 19, the verb used for the sunset is בוא; מבואו is translated as "his setting," not "his entering" (*JPS*).

the day בתקופות יום (lines 8, 9, 11). This may be translated as "in the turning points of the day" to reflect the parallelism with equinoxes and solstices, which are solar.[288] The phrase "to the statutes of the Great Light" לחוקות מאור גדול (line 8) may refer to either the sun or the moon, or to a divine source of light. The passage does not mention either luminary by name and the term is likely to be an allusion to Gen 1:16. whereby the sun is המאור הגדל, the Great Light. If so, the moon may be referred to as simply אור Light (line 9); however, the term, Light, without the superlative adjective is used in line 7 and again in line 10 to signify the sun. There are allusions to Ps. 104:19–20a, which also describes the entrance of the moon in the sky at sunset.

Lines 11 to 13 move onto the "the births of time" מולדי עת , the "foundations of time, and the solstices and equinoxes of the seasons," in the order of their signs. As has been shown from the study of 4Q318, it would be logical to interpret "the arrangement of their signs," בתכונם באותותם as, in the order of their [each day's and each month's] zodiac signs. There are also recurring motifs of repeated, or co-ordinated, astronomical cycles, sacred appointed times, and the categorisation of time. Other different words for time, including, עת, קץ, and מועד are all packed up tightly together in line 11. The text carries the reader through shifting astronomically-defined time-periods, eternity, and the conceit of the end of all time. This idea either extends the imagery of rotating units of astronomical Time and space until it disappears altogether, or it poetically references Apocalyptic Time, the End of Days.[289] The concepts can be separated as there is no supporting eschatological terminology.

The Community Rule, 'The Maskil's Hymn' (1QS Col. x Lines 1–8)

There is an intertextual relationship between the astronomical and calendrically-themed text known as The Maskil's Hymn, in the Cave 1 Community Rule, 1QS col. x lines 1–8 and the time-centred strata in the Thanksgiving Psalms discussed above. The extract, lines 1QS col. x lines 3–5 are of particular interest to 4Q318, as noted by Milik, who understood the passage to refer to the cycles of the zodiac signs.[290] The pericope is quoted below with an adapted translation.[291]

288 See also J. Penner, *Patterns of Daily Prayer in Second Temple Judaism* (STDJ 104; Leiden: Brill, 2012), 141–145, n. 13.

289 For a full discussion on the meaning of the "End of Days" in the Second Temple Judaism, see A. Steudel, "אחרית הימים in the Texts from Qumran," *RevQ* 16 (1993): 225–246.

290 Milik, *BE*, 187, with reference to 4Q209 frag 28, lines 1–5 (*1 En.* 82:9–13). §1.2. Scholarship on 4Q318: setting the problem.

291 Transliteration: *DSSSE* 94–95.

Community Rule. 1QS x 3–5

3 ... במבוא מועדים לימי חודש יחד תקופתם עם
4 מסרותם זה לזה בהתחדשם יום גדול לקודש קודשים ואות נ (*vacat*)
למפתח חסדיו עולם לראשי
5 מועדים בכול קצ נהיה (*vacat*) ברשית ירחים למועדים וימי קודש בתכונם
לזכרון במועדיהם

3. ... at the entering of the Appointed Times in the days of the new moon together; their solstices and equinoxes/turning points with

4. their cords each to the other. In their new moons, it is great day for the holy of holies and a sign *n* (*vacat*) for the releasing of his loving-kindness forever.[292] For the heads of the Appointed Times in all periods of time that shall exist (*vacat*)

5. At the beginning of the moons/months to the Appointed Times and the holy days in their order, to the days of remembrance in their Appointed Times

This section of the Cave 1 Community Rule, part of the so-called 'Maskil's Hymn,' appears in several fragments of other copies of the Community Rule. The longer hymn of which it is a part (1QS col. ix lines 26b–xi 22) is absent from the later Cave 4 copy, 4QS^{e} where it has been replaced by the 294-year calendar-cycle, *4QOtot* (4Q319).[293] Notwithstanding the scholarly discussions on the priority of composition of these recensions, it is likely that this substitution reflects a theological connection between the astronomically-themed poetry and calendrical cycles.

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292 Line 4 מסרוֹתם and למפתח cf. Job 39.5: "bonds" and "setting free" respectively.

293 P. Alexander and G. Vermes, *Qumran Cave 4. 19. Serekh ha-Yaḥad and Two Related Texts*, DJD 26 (2003), 9–12 (1QS dated to 100 B.C.E.); summary of available transcriptions of 1QS: see DJD 26, 12–13; also García-Martínez and Tigchelaar, *DSSSE* 94–95 (1QS col. x lines 1–8). Also J.H. Charlesworth et al., *Rule of the Community* (1994), 42–43. Parallel texts from Cave 4 containing the relevant section of the Maskil's Hymn in DJD 26: 4Q256 (4QS^{b}) col. xix lines 1–6 (pp. 59–60); 4Q258 (4QS^{d}) col. ix lines 1–6 (121–124); 4Q258 (4QS^{d}) col. viii lines 11–13 (114–119); 4Q260 (4QS^{f}) col. ii lines 1–5 (160–161). 4QS texts in Qimron and Charlesworth: 66–67 (MS B frag 8), 90–91 (MS F. frag 1 ii). Metso argues that *4QOtot* is an older composition than the Maskil's Hymn although 4QS^{e} is a later text, S. Metso, *The Textual Development of the Community Rule* (STDJ 21; Leiden: Brill, 1997), 48, 49, 144; S. Metso, "When the Evidence Does Not Fit: Method, Theory, and the Dead Sea Scrolls," in *Rediscovering the Dead Sea Scrolls* (ed. M.L. Grossman; Grand Rapids, MI: Eerdmans, 2010), 16–20; cf. A. Schofield, *From Qumran to the Yaḥad* (STDJ 77; Leiden: Brill, 2009), 4–5, 75–78.

The linguistic similarities between 1QS col. x lines 1–8 and 1QH[a] col. xx lines 7–14 include: משל "dominion"; תקופת "solstices and equinoxes/turning points"; אסף "gather in/retire"; מעון "abode"; מועדים "seasons/festivals/appointed times;" תכון " arrangement/fixed order." The repeated references to the "new moons," חדש, and "moon" or "month," ירח, "appointed times," מועדים and the possible entrance of the zodiacal constellations on the days of remembrance, if Milik is correct, as discussed, could ascribe a liturgical function to a zodiac calendar or calendars that involved the moon, depending on one's interpretation.

4Q503 (4Qpap Daily Prayers), 1QM (1QWar Scroll) and Various Possible Zodiacal Terms

This benedictory scroll is included in the survey of texts that may have been interested in the zodiac calendar because its ambiguous terminology is suggestive of an angelic cosmological belief system. The scroll consists of 225 fragments dated by Baillet to 100–75 B.C.E.[294] and is laid out according to a lunar calendar for one month, thematically blessing the rising sun (4Q503 col. vii lines 1, 12); there is no indication of the month-number.[295] It is structured according to blessings for the morning and evening (in that order)

294 M. Baillet, "Prières Quotidiennes (4Q503)," *Qumran Grotte 4: III (4Q482–4Q520)*, DJD 7 (1982), 105–106 (105). The text was further reconstructed by Baumgarten, "4Q503 and the Lunar Calendar," *RevQ* 12 (1986): 399–407, and reconstructed again by D. Falk, *Daily, Sabbath and Festival Prayers in the Dead Sea Scrolls* (STDJ 27; Leiden: Brill, 1998), 29–43; idem, "Reconstructing Prayer Fragments in DJD VII," in *The Dead Sea Scrolls Fifty Years After Their Discovery: Proceedings of the Jerusalem Congress, July 20–25 1997* (ed. Lawrence H. Schiffman, Emanuel Tov and James C. VanderKam; Jerusalem: Israel Exploration Society, 2000), 248–255. It was also partially restored by E.G. Chazon, "The Function of the Qumran Prayer Texts," ibid., 217–225 and in a detailed study by Francis Schmidt, "Le Calendrier Liturgique," in *Le Temps et les Temps dans les littératures juives et chrétiennes au tourant de notre ère* (ed. C. Grappe and J.C. Ingelaere; *JSJ* Supplements 112; Leiden: Brill, 2006), 55–87 (55–58). Schmidt made use of 4Q512 (*4QRitual of Purification B*) on the reverse in his restoration, contra Falk, "Reconstructing Prayer Fragments in DJD VII," 249, who stated that its content was "too broken" to aid reconstruction.

295 J.M. Baumgarten, "4Q503 (Daily Prayers) and the Lunar Calendar," *RevQ* 12 (1986): 399–407, observed that the day began in the evening: "The new day of the month is always introduced בערב with the formula: 'On such-and-such day of the month in the evening' . . . "The sect did not repudiate the lunar calendrical calculations, as was done in *Jubilees*, but used them as a framework for liturgy." 403–404, 406; idem, "The Calendar in the Book of Jubilees and the Temple Scroll," *VT* 37 (1987): 71–78; see also R.T. Beckwith, "The Essene Calendar and the Moon: A Reconsideration," *RevQ* 15 (1992): 457–466; R.T. Beckwith, *Calendar and Chronology, Jewish and Christian: Biblical, Intertestamental and Patristic Studies* (Leiden: Brill, 2001), 114–115. 4Q503 was first published by Baillet, DJD 7, 105–136.

for successive days of the calendar. Day 15, in the evening, is the full moon (4Q503 col. vii lines 6), which is also blessed.[296] The month described is probably a 30-day month which begins at the first visible crescent.[297]

The possible allusions to Passover: a pun on the verb פסח with another allusion to the Exodus [Exod 15:6] in line 4Q503 frag 7 (frags 1–3) lines 5ab:[298]

בפסחו[בכו]ח יד גבורת[ו

> in his passing over . . . [by the streng]th of [his] mighty hand

and, possibly to the Feast of Unleavened Bread in line 13b:

א]שר לחגי שמחה ומועדי כ[בוד

> wh]ich are for the pilgrim festivals of joy and the Appointed Times of g[lory

The Passover reference convinced Falk to reconstruct the text and identify the month as the first in the year.[299] Chazon argues that 4Q503 was intended to

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296 Reconstruction of col vii (frags 1–3) 1–15 by Falk, "Reconstructing Prayer Fragments in DJD VII," 253; idem, *Daily, Sabbath and Festival Prayers in the Dead Sea Scrolls*, 33–34. (So Schmidt, "Le Calendrier Liturgique," Annexe 2, 84).

297 The full moon on the 15th day of the month is attested in tablet V 12–22 of the Babylonian Creation epic, *Enuma Eliš*, the astronomy in the passage is explicated by J.M. Steele, "The Length of the Month in Mesopotamian Calendars of the First Millennium," in *Calendars and Years: Astronomy and Time in the Ancient Near East* (ed. J.M. Steele; Oxford: Oxbow Books, 2007), 133–135 ("Thus, the day of full moon is assumed to take place at the middle of the month, on the fifteenth day, implying that the new moon crescent was visible on the first day of the month. In practice, full moon will sometimes take place on the fourteenth day of the month, but the text, . . . assumes that month will be 30 days long.") Cf. M. Wise, "Second Thoughts," 101, and Ben-Dov, *Head of All Years*, 136, both of whom state that the month in question in 4Q503 began with the conjunction, the day before first visibility. Although Ben-Dov also accepts Schmidt's deduction (as day 1 is not extant) that there was a "Plus Jeune Lune" of 0.25/7ths (a small fraction, one quarter of one seventh, where seven-sevenths would represent the full moon) on the first day of the month: Schmidt, "Le Calendrier Liturgique," 65–66 (Table 1).

298 Reconstruction by Falk, *Daily, Sabbath and Festival Prayers*, 33–34. My translations.

299 Falk, "Reconstructing," 252–253; cf. Abegg, "Does Anyone Really Know?"402, argues that the month is the seventh month, based on his attempt to fit 4Q503 into the triennial cycle and align the text with *dwq* and the first crescent in 4Q321. Chazon argues that line 8b:

be recited communally at specific times of each day together with the angels at sunset and sunrise to give praise to the daily renewal of the solar and lunar light in co-ordination with the phases of the moon.[300] Alexander regards the text in a similar vein and includes the fading and reappearance of the stars in the blessing to the luminaries.[301] The prayer text is rich in intertextual terminology, specifically, "standard (as in flags)," דגל, "lot" גורל and "sign" אות, that may, or may not, have zodiacal concepts attached to them depending on their contexts; a small selection is now surveyed.

With reference to 4Q503, Baillet suggests that "standard," דגל when it is preceded by a number (possibly associated with "gates of light" in the text may mean, "troupe ou groupe d'etoiles?"[302] The possible astronomical, or astrological construct used in 4Q503 אור דגֹלי/לילה flags, or troops or companies of light/(or) night appears with frequency.[303]

4Q503 frag 7 (frags 1–3) lines 3–4

3 בארבע[ה עשר שערי אור]לנו ממשל°[
4 עשר דג[די]°וא חום ה[שמש

3 in the four[teenth gate of light . . .] for us dominion [. . .]
4 –teen tro[ops . . .] heat of the [sun . . .][304]

"our redemption" פדותנו from the root פדה "ransom" [BDB 804] supports the reference to the Exodus, but disagrees that בפסחו is a reference to Passover, in "The Function of the Qumran Prayer Texts," 220 n. 13.

300 Chazon, "The Functions of the Qumran Prayer Texts," 217–227. idem, "Liturgical Communion with the Angels at Qumran," in *Sapiential, Liturgical and Poetical Texts from Qumran: Proceedings of the Third Meeting of the International Organisation for Qumran Studies, Oslo 1998* (ed. D. Falk et al.; STDJ 35; Leiden: Brill, 2000), 95–105; idem "Human and Angelic Prayer in Light of the Dead Sea Scrolls," in *Liturgical Perspectives*, 35–48.

301 Alexander, *Mystical Texts*, 65–66.

302 Baillet, DJD 7, 107 (with reference to 4Q503 1 4, since incorporated into frag 7 by Falk, "Reconstructing").

303 Frag 7 (1–3, Falk, ibid.) 4, *DSSSE* 999–1007: frags 7–9 4, 10 2, frags 29–30 11, 19; Dennis T. Olson, "Words of the Lights", 235–285, also: frags 37–38 12 5, 39 13 2, 51–55 8, 100 2, 215 4.

304 Falk, *Daily, Sabbath and Festival Prayers*, 33–34.

Chazon has translated 4Q503 frags 8–9, col. ii lines 1–5:

:]בני בריתכה נהלל [...] עם כול דגלי [אור

"[We] the sons of your covenant shall praise [...] with all troops of light."[305]

The phrase ודגלי חודשים and the troops of the months," (literally) in 4Q286 *4QBerakhot*[a] frag 1, col. II lines 8–9[306] is translated by Nitzan as "divisions of months" in lines 8b–13. She comments that the construct suggests a specific organisation of time into periods of months: "God's astronomical and calendrical mysteries are listed according to the divisions of time by the systematic use of [the consonant] *bet* [within the text]."[307] Nitzan translates the same term in 4Q503 as "troops" and regards the daily prayers as having "an astronomical and historical reason" at Qumran.[308]

In 4Q503, the days of the month are aligned to phases of the moon in proportions of fourteenths of "lots" *gorâlot* (pl.) of light and darkness/night גרלות אור/חושך/לילה.[309] Falk compares the scheme to the incremental portions of illumination according to the days of waxing and waning in the Ethiopic Astronomical Book of Enoch [*1 En.* 73–75, 78–79].[310] Hence, "the moon is regarded as having fourteen parts which fill up and empty respectively during waxing and waning."[311] If so the light of this study's research showing that the stars were also used in the Aramaic zodiac calendrical texts, it is possible that

305 Chazon, "The Function," 223; eadem, "Liturgical Communion," 106.

306 Nitzan, DJD 11, 16, "Comments," 16 n. 14. Nitzan notes that a similar term appears in 4Q502 27 3 (יר[חים דגלי) and liturgical texts such as 4Q503 "possibly pointing to the heavenly liturgical hosts who praise God at appointed times."

307 Nitzan, DJD 11, 4.

308 B. Nitzan, *Qumran Prayer and Religious Poetry* (STDJ 12; Leiden: Brill, 2004), 55–56, n. 29 and n. 31.

309 *DSSSE* 999–1007: frag 4, line 10, frag 39, line 2; frag 51–55 lines 2, 14; Arnold, *Social Role of Liturgy*, 123 n. 64.

310 Falk, *Daily, Sabbath and Festival Prayers*, 31–32.

311 Falk, "Reconstructing," 252, citing Milik, *BE*, 274–284. See also Abegg, "Does Anyone Really Know?" 398–402, and Baumgarten who also noted that the "same method" was used. He commented: "In 4Q503, the liturgical application is saliently emphasised, with each phase of the moon accompanied by an appropriate blessing... It also makes it difficult to accept the scholarly premise that the luni-solar calendar was a late import into Jewish practice which aroused the antagonism of the faithful," idem, "4Q503 (Daily Prayers) and the Lunar Calendar," 405.

the use of the term *gorâl* "lot" in 4Q503 frags 51–55, line 14 may at times symbolise a lunar phase, and *ot*, a "sign," may refer to a zodiac sign:[312]

4Q503 frags 51–55, line 14

14. [...]גורלות אור למען נדע באותו[ת]

14. [. . .] the lots of light so that we may know the signs.[313]

As shown in Chapter 1, the zodiac signs that the moon passes through each day of the month in a 360-day year are listed in their order in the calendar of 4Q318. The moon is a visual calendar, it is possible to tell the date of the month from its waxing and waning, and hence, its position in the zodiac. The phrase, ובגורל אור הפלתנו "and into the lot of light You cast us," is attested in the Community texts, *1QWar Scroll* (*1QMilḥamah,* or *1QM*) (1Q33) col. xiii, line 9[314] and *4QWar Scroll*[e] (*1QWar Scroll 4QM*[e])(4Q495) frag 2, line 1.[315] They may be examples of the possible use of metaphors of the moon's light to reflect the congregation's relationship with the divine, destiny, and fate.[316] There are subtle alternative uses of the term that imply that "lots" may also be connected with the consequences of praising at the proper time.[317] The "lot of darkness" could thus be linked to curses:

312 It is understood that this interpretation is open to further discussion.

313 *DSSSE* 1006–1007; cf.: 4Q503 frag 54 line 4 [...ד]אות לנו לילה במוע[...]: [...] "a sign for us for the night of the festival/ appointed time (ibid.). Ben-Dov rules out the hypothesis by D. Nahman ("When Were the 'Daily Prayers' (4Q503) Said in Qumran?" *Shnaton* 13 (2002): 178–181 [Heb.]), which postulates that the prayers were said at the beginning of each triennial cycle (as the אותות in 4Q319 occur at these points), in *Head of All Years*, 138 n. 7. If so, the meaning of את as a heavenly sign, astronomically, rather than calendrically, in this text, should be considered. As discussed, the term could refer here to the correct zodiac sign for the festival or appointed time.

314 Sukenik, *The Dead Sea Scrolls of the Hebrew University*, pls. 14–34; Milik, DJD 1, 135–136, pl. 31.

315 Baillet, DJD 7, 54–56, pl. 8.

316 See also A. Lange, "The Determination of Fate by the Oracle of Lot in the Dead Sea Scrolls, The Hebrew Bible and Ancient Mesopotamian Literature," in *Sapiential, Liturgical and Poetical Texts from Qumran* (ed. D. Falk et al.), 39–48 (42); idem, "The Essene Position on Magic and Divination," in *Legal Texts and Legal Issues: Proceedings of the Second Meeting of the IOQS, Cambridge 1995 in Honour of J.M. Baumgarten* (ed. M. Bernstein et al.; STDJ 23; Leiden: Brill, 1997), 395–396.

317 So possibly 4Q511 (4QShir-b) frag. 2, col. i: lines 1–10.

1QM col. xiii line 5b

5b כיא המה גורל חושך גורל אל אור .6 [עולמ]ים *Vacat*

5b. For they are the lot of darkness but the lot of God is for [6] [everlast]ing light[318]

1QM col. xiii lines 11f–13a = 4Q495 frag 2 line 3d–4

11f ... וכול רוחי 12 גורלו מלאכי חבל בחוקי חושך
... יחד ואנו בגורל אמתכה נשמחה ביד 13 גבורתכה

11f... All the spirits [12] of his lot are angels of destruction, they walk in the laws of darkness ... We, together, in the lot of your truth, rejoice in [13] your mighty hand ...[319]

The opposite of praises recited by those who are blessed by angels, or by the angels themselves, would not conflict with the possible meaning of the construct phrase, גורל חושך "lot of darkness" as a bad destiny. Monologues of curses against Belial include: *4QBlessings*[a] (4Q286 or 4Q Ber[a]) frag 7, col. ii line 4, [recon] and *4QBlessings*[b] (4Q287 or 4Q Ber[b]) frag 6, line 4;[320] so, also 1QS col. ii line 5. It is possible that a cursed human group, or cursed angels, may be uttering their praises at a different time, the incorrect time in a calendar.

2.4.3 *The Question of the Practitioner*

Having put forward the argument in agreement with Greenfield and Sokoloff that 4Q318 is probably non-sectarian and possibly known to the different

318 García Martínez and Tigchelaar, *DSSSE* 134–135.

319 García Martínez and Tigchelaar, *DSSSE* 134–135 (translation slightly adapted).

320 (Dated to 50 C.E.) B. Nitzan, DJD 11, 7–48, 49–60, pls. 1–4, 5–6. Nitzan discusses the concept of divinely ordained "lots" apportioned to humans as a principle of predeterminism in: "The Ideological and Literary unity of 4QInstruction and Its Authorship," *DSD* 12.3 (2005): 269–270. In comparison, Francis Schmidt discusses the practice of casting lots to establish a hierarchy of authority in the Community, in: "Gôral Versus Payîs: Casting Lots at Qumran and in the Rabbinic Tradition," in *Defining Identities: We, You, and the Other in the Dead Sea Scrolls: Proceedings of the Fifth Meeting of the IOQS in Groningen* (ed. F. García Martínez and M. Popović; STDJ 70; Leiden: Brill, 2008), 175–185 (177–180); also A. Lange, "The Essene Position," 408–410.

groups within Second Temple Judaism, this discussion will turn to the issue of its user. Philip Alexander states that Josephus had demonstrated that the interpretation of omens "required great skill" and that the practice may have been regarded "specifically as a priestly perogative."[321] The question is whether 4Q318 was used at Qumran or by practitioners in the wider society, or both. As noted in the Introduction, Josephus states that the Essenes could foretell the future. Since the "men of knowledge," λογιοι, interpreted portents at the siege of Jerusalem (*J.W.* 6.295–6), the reading of supernatural signs was not a sectarian speciality. The probable non-sectarian origin of 4Q318 supports the likelihood that omen prognostication was a shared province with others in the wider community.

Geller postulates that 4Q318 was originally a copy from the national library at the Temple in Jerusalem, (or that it came from the collection itself) because of the cultural eclecticism of the brontologion.[322] These ideas support the possibility that the genre of 4Q318 had an extensive reach, rather than it being some kind of anomalous work.

There is the probability that an effort was made to preserve and possibly use the composite text by copying it into a portable form whence it was taken to Qumran. Its convenient traveller-size could also mean that it was made to be carried out of Qumran and was actively being used for lay astronomical-astrological practise, or in a scribal school as an educational and literary artefact.

Due to the fact that this document was in Cave 4, the location of the other calendrical texts, there is no reason not to suppose that the *4QZodiac Calendar* and the Jubilees-Qumran calendars were not of equal importance. There is no evidence that they were separated. From a general standpoint, it may be said that the wider Jewish community did not restrict access to its specialist knowledge, and that therefore, it was part of the Qumran collection. As demonstrated in Chapter 1, *4QZodiac Calendar* would not have been difficult to use once an elementary education had been achieved. Since it is not a secret text, from another perspective, if was a pedagogic text, its contents could have been shared within Second Temple Judaism as part of general knowledge, culture and scholarship.

321 Alexander, "Zodiology and Brontology," 1.504.

322 Professor Mark Geller, "Divination from Ancient Palestine: The View from Babylonia," presentation at the Society for Old Testament Study, 6 January 2009, Cambridge, UK.

2.5 Summary and Conclusion

This chapter addressed several problems that characterise the study of *4QBrontologion*: its cultural background and sources, the fact that this is a unique primary source in Aramaic, and its place within the complex of Judean groups. It also looked at the possible relationship of *4QZodiac Calendar* thematically with other scrolls.

Some of the paleographical features were of interest, particularly the linguistic feature that may suggest that the scribe was an active user of Hebrew (p. 183). That possibility would support the paleographical findings in Chapter 1, where it was suggested that there were scribal similarities with a historical Hebrew text (pp. 155–156). The question of the origins of *4QBrontologion* was treated differently to that of the *4QZodiac Calendar* because the zodiac calendar can function independently of the brontologion. The zodiacal thunder omen would require a zodiacal calendar of some sort.

There may have been a wide interest in different types of zodiac calendars, solar and lunar, incorporating a variety of new years, in the medieval period. The Byzantine texts could have been adapted in secondary sources, retaining the protases and apodases based on 4QBrontologion-style zodiac omen texts ("If it thunders in when the moon is in zodiac sign X" . . .) combined with (. . . . then *as a well known ancient authority such the Chaldeans, or Babylonians, or Egyptians or Eudoxus* says, the consequences for the king, country and people {*affected by X*} will be Y). No others are attested in Babylonian or Hellenistic sources. These texts may be a form of judicial astrology in a popular, manufactured archaic style without the names of unfamiliar Akkadian kingdoms. The anachronistic replication may have been conceived for effect, and the authentic references to Babylonian cities and countries removed in order to give the texts an accessible sheen, with an ancient citation invented for authority.[323] However, these attributions were also used in late antiquity.

There were major variants in the medieval calendars which are not attested in 4Q318, or in the Babylonian material. If the broken Greek brontologion from the 13–14th century Oxford Parapegma had been added to the Augustan parapegma in antiquity, the possibility exists that it could have been appended before the end of the reign of Augustus, which is roughly contemporary with 4Q318 pp. 204–207). However, it is more likely that the two texts were copied together as one single manuscript at a later date, particularly since the thunder omen text is incomplete. The primary source material that antedated 4Q318

323 Ptolemy details the 'Chaldean' and 'Egyptian' methods of interpreting horoscopes, in Ptolemy, *Tetrabiblos* I 20–22 (Robbins, LCL), 91–111.

would suggest that *4QZodiac Calendar* and *4QBrontologion* derived in the main, from scholarship in Mesopotamia.

Finally, this chapter considered the question of the purpose and theoretical practitioner of 4Q318. I argued the text was probably non-sectarian and, further, that it is compatible with the interests of the Essenes as described by Josephus. It is also in keeping with his narrative of the general "men of knowledge" within wider Judean society who could interpret portents. 4Q318 could have been used as a mythological apparatus for teaching astronomy-astrology, particularly in terms of the 360-day zodiac calendar. The scroll's constituent parts echo the Enochic and Jubilean literary material describing the cosmological knowledge and divinatory skills of the descending angels. It was suggested that 4Q318, due to its content, was a mythical book that belonged to the angels listed in *1 En*. 6:7 and *1 En*. 8:3, and served as a book-within-a-book. Further, the question was posed whether humans could have used the zodiac calendar to unite with the angels at the proper time to communicate with the divine. Based on the manuscripts discussed, I would suggest that the 4Q318 fits in well as an angelic book of instruction; that it is not only relevant to the angelology of the Essenes described by Josephus, but may be part of the teaching of calendrical science and astronomy in Judea. On a discursive philosophical level, the narrative in *Jubilees* found at Qumran and its later antique tradition connecting Abram with the practice of, and his views on, meteorological astrology, contrasts with the revelation of angelic knowledge to Enoch, which is also extant in the Dead Sea Scrolls. There is no contradiction between 4Q318 reflecting popular intellectual pursuits in Judea and having a place in Cave 4 at Qumran.

CHAPTER 3

The Aramaic Astronomical Book of Enoch Reconsidered in the Light of 4Q318

3.1 Introduction

This chapter will examine particular elements in the Aramaic fragments of the Astronomical Book of Enoch in the Dead Sea Scrolls, *4QAstronomical Enoch*$^{a-d}$ (4Q208–4Q211)[1] that may have a connection with *4QZodiac Calendar*. Armin Lange and Ulricke Mittman-Richert listed the texts together as a genre in a classification of calendrical manuscripts in the Dead Sea Scrolls,[2] the first time that the texts had been catalogued collectively in a critical volume.

Before moving on to discuss the calendar in the Qumran material, this chapter engages with the reception history of the astronomical sections of the Ethiopic *Book of Enoch* (*1 Enoch*) one of the canonical books of the Ethiopian Bible. Chapters 72–82 are known collectively, variously, as the *Book*

1 The critical edition of the astronomical fragments that are related to *1 En*. 72–82, is J.T. Milik, *The Books of Enoch: Aramaic Fragments of Qumrân Cave 4* (Oxford: Clarendon, 1976) [abbrev: *BE*]. He did not examine all the fragments and the volume has been superceded in breadth by later scholarship. E.J.C. Tigchelaar and F. García Martínez produced the critical edition of all the 4Q208–4Q209 fragments, "4QAstronomical Enoch^{a-b}," *Qumran Cave 4:26. Cryptic Texts and Miscellanea Pt 1*. (ed. S.J. Pfann, et al., DJD 36; Oxford: Clarendon), 95–171. Frags *4QEnastr*^{c} and *4QEnastr*^{d} (4Q210 and 4Q211, respectively) were not published in DJD 36. Until recently Milik's *BE* was the *editio princeps* for these Aramaic fragments: 4Q210 (*4QEnastr*^{c} *ar*), 274, 284–88, 292–3, pls. 28, 30; 4Q211 (*4QEnastr*^{d} *ar*), *BE*, 274, 296–297, pl. 29. All have now been published in full in H. Drawnel, *The Aramaic Astronomical Book* (*4Q208–4Q211*) *from Qumran* (Oxford: Oxford University Press, 2011), it is not a principal edition. This study follows Drawnel's manuscript titles for the corpus: *4QAstronomical Enoch*$^{a-d}$ (4Q208–211).

2 A. Lange and U. Mittman-Richert, "Annotated List of the Texts from the Judaean Desert Classified by Content and Genre," *Texts from the Judaean Desert*, Emanuel Tov et al., eds., DJD 39 (Oxford: Clarendon, 2002), 135–6 (listed as: "4QEnastr (*1 Enoch* 72–82): *4QEnastr*$^{a-d}$ *ar* (4Q208–4Q211) and *4QZodiology and Brontology ar* (4Q318) iv–viii 6"). The titles *4QEnastr*$^{a-d}$ *ar* used in Milik, *Books of Enoch* and Lange and Mittman-Richert (op. cit) were changed by Tigchelaar and García Martínez in the critical edition of *4QAstronomical Enoch*$^{a-b}$ (4Q208–4Q209): 4Q208, DJD 36, 104–131 (pls. 3–4); 4Q209, DJD 36, 132–171 (pls. 5–7).

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of Luminaries, or the Ethiopic Astronomical Book of Enoch, or *1 En.* 72–82.[3] The Ethiopic *Book of Enoch* including the astronomical chapters, *1 En.* 72–82, is believed to have been originally composed in Aramaic, then into Greek, before its translation into Ge'ez and Ethiopic.[4] According to Milik's estimation various components of *1 En.* 72–82 overlap loosely by about "30 per cent" with the astronomical Aramaic fragments from Qumran, *4QAstronomical Enoch*$^{a-d}$ (4Q208–4Q211).[5] The Aramaic manuscripts that comprise the self contained 'synchronistic calendar,' the main focus of this chapter, *4QAstronomical Enoch*^{a} (4Q208) and most of the manuscript remains of *4QAstronomical Enoch*^{b} (4Q209), do not exist anywhere in *1 Enoch* and were unknown before the discovery of the Dead Sea Scrolls.[6]

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3 Milik, *BE*, 83–8; Knibb, *Ethiopic Book of Enoch*, 1–46; M. Black, *The Book of Enoch or 1 Enoch: A New English Edition with Commentary and Textual Notes* (SVTP 7; Leiden: Brill, 1985), 1–12; D. Olson, *Enoch: A New Translation* (North Richland hills, Texas: BIBAL, 2004), 20–22; J.C. VanderKam, "1 Enoch 72–82: The Book of Luminaries," in *1 Enoch 2: A Commentary on the Book of 1 Enoch Chapters 37–82* (ed. G.W.E. Nickelsburg and J.C. VanderKam. Minneapolis: Fortress, 2012), for the latest and most comprehensive introduction to the relationship between the Aramaic fragments of the Astronomical Book from Qumran and the Ethiopic Astronomical Book, see, 334–407, for the translation with the most recent and detailed apparatus that includes the Aramaic material, 409–569. For Vanderkam's translation of the *Book of Luminaries* with succinct footnotes simply containing parallel material from the Aramaic fragments, see G.W.E. Nickelsburg and J.C. VanderKam, *1 Enoch: A New Translation* (Minneapolis: Fortress, 2004), 96–116.

4 Nickelsburg and VanderKam, *1 Enoch: A New Translation*, 13–14; J.C. VanderKam, *1 Enoch 2*, 335–352; Matthew Black states that there was an Aramaic version in possibly more than one recension and possibly a Hebrew version of the Book of Enoch: "For all parts of the book, there is a general agreement that the Ethiopic is a tertiary version, a translation of a Greek *Vorlage*, itself rendering an Aramaic and/or Hebrew Grundschrift." in Black, *Book of Enoch*, 3, 4; Black further states that the Ethiopic texts "go back ultimately to this Aramaic Enoch . . ." in M. Black, *The 'Astronomical' Chapters of the Ethiopic Book of Enoch (72 to 82) with Additional Notes by Matthew Black*, DKDVS 40:10 (1981) 34. No Hebrew fragments from any part of known the Book of Enoch or the previously unknown astronomical fragments (the 'synchronistic calendar') have been found.

5 Milik, *BE*, 5, 273–97; Black, *'Astronomical' Chapters*, 34–40; M. Knibb, *The Ethiopic Book of Enoch* (Oxford: Oxford University Press, 1978), 13–15; J.C. VanderKam, "Sources for the Astronomy in 1 Enoch 72–82," in *Birkat Shalom* (C. Cohen et al. eds., Winona Lake: Eisenbrauns, 2008), 971–2; VanderKam, *1 Enoch 2*, 334.

6 Sacha Stern suggests that these manuscript fragments and "the other Qumran calendrical texts . . . , are no more than *commentaries* or exegetical expansions of the original book of *Enoch*." S. Stern, *Calendar and Community: A History of the Jewish Calendar 2nd Century BCE–10th Century CE* (Oxford: Oxford University Press), 6 (Stern's *italics*). J. Ben-Dov argues

The manuscript history of *1 Enoch* in the Western world dates from the eighteenth century when the Scottish traveller James Bruce (1730–1794) brought back three copies from Abyssinia, two of which are now in the Bodleian Library in the University of Oxford, and one, that he presented to Louis XV, is in the Bibliothèque Nationale de France, in Paris.[7] The first English translation from the Ge'ez with a commentary, in 1821, was by Richard Laurence (1760–1838), Regius Professor of Hebrew and canon of Christ Church, Oxford, later Archbishop of Cashel, Ireland.[8] As shall be discussed, his original theory pertaining to the zodiac in the astronomical section was later incorrectly attributed to R.H. Charles, one of its proponents, by Otto Neugebauer, who repudiated it. Neugebauer's views were followed by subsequent generations of scholars. Laurence's analysis is at the heart of this study's research question on whether the zodiac is in fact represented in the *Book of Luminaries*.

My investigation of a possible connection between the Aramaic scrolls, *4QZodiac Calendar* and *4QAstronomical Enoch*$^{a–d}$ is built up in stages. Firstly, the theories on the question of the presence of the zodiac in the *Book of Luminaries* are examined. Secondly, I consider the foundation of the consensus position on this subject by re-analysing the content of the manuscripts of medieval Ethiopic lunar tables that have been incorporated into current scholarship on the *Book of Luminaries*.[9] I then analyse the synchronistic calendar from Qumran, *4QAstronomical Enoch*$^{a–b}$ (4Q208–4Q209) and propose a new theory about its structure. Finally, I test the hypothesis that there is a possible relationship between *4QZodiac Calendar* and this calendar.

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that since these material fragments themselves do not contain any known content from the Ethiopic Book of Enoch or its *Book of the Luminaries* it is unlikely that they are expansions of existing material, and thus by implication that they are younger texts. He states, furthermore, that since there are, in fact, some components of 4Q209 in the *1 En.* 76–79, 82 of the *Book of Luminaries* Stern's hypothesis is "unwarranted." J. Ben-Dov, *Head of All Years*, 74–77. I would add that the age of the Aramaic astronomical fragment, *4QAstronomical Enoch*^{a} (4Q208): the late third century—early second century BCE date given by Milik (*BE*, 273) is not supported by radiocarbon dating (see Section 3.2.4), so any discussion hinging on the ages of these texts can only be speculative at present.

7 Knibb, *Ethiopic Book of Enoch, 1*; VanderKam, *1 Enoch 2*, 371. E. Ullendorf, "James Bruce of Kinnaird," *The Scottish Historical Review* 32/ 114 (1953): 133.

8 R. Laurence, *The Book of Enoch the Prophet* (Oxford: Oxford University Press, 1821).

9 These are the Ethiopic "Computus" Treatises (ECT), meaning that they were used for determining the date of Easter which follows a lunar calendar, see Neugebauer, *HAMA*, 624; idem, *'Astronomical' Chapters*, 3–5.

3.1.1 *The Question of the Zodiac in the Ethiopic* Book of Luminaries

The focus of this section is to investigate whether the 'gates' of heaven in the first chapter of the *Book of Luminaries, 1 En.* 72: verses 2–35 correspond with the 12 signs of the zodiac. The heavenly gates are described as gates of the sky through which the sun rises in the east and sets in the west every day (*1 En.* 72:2–3).[10] The 'gates' are numbered from 1 to 6, and there are six in the east and six in the west (*1 En.* 72:2–3a). The moon and stars also the use the 'gates' (*1 En.* 72:3b). Parts of this section will also discuss the moon's journey through the 'gates' in reference to *1 En.* Chapters 73, 74 and 78.

The sun's journey in *1 En.* 72 is presented as passing through each numbered 'gate' on a month-by-month basis. The months are 30 days long, so the year is 360 days with four extra days for the solstices and equinoxes in Months III, VI, IX and XII, which are 31 days long (*1 En.* 72:2–36).[11] The solar year is, therefore, 364 days in length (*1 En.* 72:32). Unlike the Jubilees-Qumran calendar, the year is not divided into 52 weeks with numbered days of the week.

The solar year in *1 En.* 72:2–35 begins in the spring, Month I, when the sun rises and sets in Gate 4 (*1 En.* 72:6). The literary narrative in the Ethiopic *Book of Luminaries* does not state that the 'gates' symbolise the zodiac signs. The verses in Chapter 72 are apparently mainly interested in: (a) The 'gate' number of the heavenly gates, (b) the ordinal of each month when the sun rises and sets in the particular numbered 'gate,' and (c) the seasonal daylight hours of each month. This apparently simple scheme has elicited an anachronistic division between scholars extending to a near-200 year old history, when in the early nineteenth century the association between the 'gates' and the zodiac signs was first mooted.[12]

The connection between the enumerated heavenly gates, six in the east and six in the west, and the order of the 12 zodiac signs was outlined in detail by Laurence in his 1821 commentary, entitled "Remarks" accompanying his English translation of the Ethiopic *Book of Luminaries*. In his translation these

10 The main translation used here is G.W.E. Nickelsburg and J.C. VanderKam, *Enoch 1: A New Translation* (Minneapolis: Fortress, 2004), 96–116, here 96. (So also, the translation in VanderKam *1 Enoch 2*, 409–568, here 416).

11 Nickelsburg and VanderKam, *1 Enoch*, 96–99.

12 VanderKam, "Sources," 966–7; for a summary of the historical background of scholarship on the Ethiopic Astronomical Book, including the acceptance in the nineteenth and early twentieth century that the 'gates' were equivalent to the zodiac signs, see VanderKam, *1 Enoch 2*, 371–3.

sections appear as Chapters 71, 72 and 73,[13] not as Chapters 72, 73 and 74 as they were subsequently arranged.

Laurence's interpretation of the 'gates' influenced the commentary in the German translation of the astronomical section of the Ethiopic *Book of Enoch* by Andreas Gottlieb Hoffmann of the University of Jena, in 1833. Hoffmann cites Laurence in his explanation of the theory of the order of the signs of the zodiac in the astronomical system of the *Book of Luminaries*.[14] The zodiacal theory of the heavenly gates was also accepted and summarised by August Dillmann whose translation and commentary in 1853 superceded that of Gottlieb.[15]

In the early twentieth century François Martin took this aspect of scholarship to a more culturally precise level in his translation of the *Book of Luminaries* by suggesting that the 'gates' were correlated with the signs of the zodiac, which he attributed to having Babylonian origins (in his commentary to *1 En.* 72:6. He also suggested in the same note that the first month in "la grande porte" probably correlated to the Babylonian new year of Nisan {March–April}).[16] Robert Henry Charles highlighted the theory that the 'gates' may have represented the signs of the zodiac;[17] although, he claimed that the authors of the Ethiopic Book deliberately concealed the zodiac because it was a "heathen" concept.[18] He did not explain how all the zodiac signs might have corresponded to all the 'gates,' mentioning only Aries and Libra with respect to their gate numbers in relation to the movements of the sun and the moon in his extended note to his translation of *1 En.* 74.5.[19] This note appears to be a paraphrase of Laurence's comments on this verse (in Laurence's text *1 En.* 73.5).[20] Although Laurence

13 Laurence, *The Book of Enoch the Prophet*, 197–202, 205–6.

14 A.G. Hoffmann, *Das Buch Henoch* (Jena: Croeker, 1833), 585–6 n. 20.

15 A. Dillman, *Das Buch Henoch* (Leipzig: Vogel, 1853), 42–44, 223.

16 F. Martin, *Le Livre d'Hénoch traduit sur le texte éthiopien* (Paris: Letouzey & Ané, 1906), 165–6, note 6, to *1 En.* 72:6: "L'auteur explique cette apparence par un système de six portes au levant et au couchant répendant aux douze signes du zodiaque des Babyloniens."

17 R.H. Charles, *The Book of Enoch or 1 Enoch* (Clarendon: Oxford, 1912, reprinted in R.H. Charles, *The Apocrypha and Pseudepigrapha of the Old Testament.* Vol 2 {ed. J.H. Charlesworth; Oxford: Clarendon, 1966}), 2:163–281.

18 See the notes by Charles on *1 En.* 72, Note 2: "Here begins an account of the sun in its progress through the signs of the zodiac, and the resultant increase and decrease of the days and night." *1 En.* 72, Note 8: "The author replaces the heathen signs of the zodiac by portals;" 74, Note 5: "When the sun is in Aries and Libra the new moon and the full moon are in the third and fourth portals." 75, Note 3 "'signs,' ie: of the Zodiac. Charles translated *1 En.* 72:13, 19 with the phrase "on account of its sign" see Charles, *Enoch*, 2:237–8, 240–1.

19 Charles, *1 Enoch*, 240.

20 Laurence, *The Book of Enoch the Prophet*, 201.

explained how and why he understood that the Ge'ez text was garbled in terms of its astronomy at this point, Charles merely summarised Laurence without explaining that the text required clarification and nor did he cite Laurence as his source. Consequently, Charles's note is problematic.[21] Charles may have assumed that a possible correlative relationship between the 'gates' and zodiac signs was obvious (although clearly that was not to be the case in the future), or that the method was so very well known to scholars in the early twentieth century, probably because of Laurence's work, that there was no need to actually explain it or reference Laurence's edition and commentary.

More than half a century later, in 1970, R.T. Beckwith briefly mooted the idea that the 12 'gates' "corresponded in some way" to the signs of the zodiac, based on the rudimentary knowledge of 4Q318 from the 1950s that had been published by that time.[22] The subject was raised again in 1976 by J.T. Milik, in his critical edition of the Aramaic fragments. He proposed that the concept of the zodiac was used in *1 Enoch*. He stated:

> the [Ethiopic] Astronomical Book [*1 En.* 72–82] and the Book of Watchers [*1 En.* 1–36], seem to know the system of the Zodiac . . .[23]

(Furthermore, Milik translated *4QAstronomical Enoch*^{b} (4Q209) frag 28, line 1 ל[מעדיהון] as "[. . . with regard] to their Zodiacal periods." (= *1 En.* 82: 1c).[24] This interpretation was related to his translation of מועדים in *The Community Rule* (1QS) col. x lines 3, 5, as the "zodiac."[25] Milik's view was rejected by J.H. Charlesworth who translated מועדים in 1QS col. x lines 3, 5 as "seasons."[26] Matthew Black remarked that there was "no astronomical justification for taking מעדיהון as 'signs of the Zodiac.' "[27] Philip Alexander and Geza Vermes,

21 See discussion with Fig. 3.1.2.

22 R.T. Beckwith, "The Modern Attempt to Reconcile the Qumran Calendar with the True Solar Year," *RevQ* (1970), 389–396 (394), ref: J.T. Milik had referred briefly to "4QZodiac" in *Ten Years of Discovery*, 42 n. 4, 119.

23 Milik, *BE*, 337–338.

24 Milik, *BE*, 295. *olim* 4QEnastr^{b} frag 28 = *1 En.* 82: 9–13 (pl. 30) *See* 335 n. 249.

25 See Milik, *BE*, 187, commenting on 1QS column x lines 2–5 "with some corrections borrowed from the manuscripts of 4QS." He, in turn, associated this with 4Q318, then unpublished, see also the brief discussion on 'Scholarship' in Chapter One.

26 J.H. Charlesworth, ed., *Rule of the Community and Related Documents* (Tübingen: Mohr-Siebeck, 1994), 43. With regards to 1QS col. x line 3, Charlesworth noted: "The author of this section must have known the astronomical knowledge found in the Books of Enoch. . . ." Charlesworth, *Rule of the Community*, 43 n. 252.

27 Black, *'Astronomical' Chapters*, 39, note to *1 En.* 82:9.

and Matthias Albani also expressed disagreement with Milik's translation pertaining to the zodiac in *The Community Rule*.[28] Milik's translation of the zodiac in 4Q209 frag 28, line 1 has been accepted and followed by the editors of the principal edition of *4QAstronomical Enoch*$^{a-b}$ (4Q208–4Q209), Tigchelaar and García Martínez,[29] though not by Henryk Drawnel.)[30]

The chief advocate against the view that zodiac was signified in the *Book of Luminaries* was Neugebauer, who died in 1990, two years before 4Q318 was published by Eisenman and Wise.

In his translation of the *Book of Luminaries*, Neugebauer briefly noted his opposition to the hypothesis that the zodiac signs were indicated in *1 En.* 72:13, 19. In these verses the sun rises and sets in 31-day months in specific 'gates.' He emphasised that each of these 'gates' had particular characteristics that related to the season, that is, the solstices and equinoxes. He noted that Charles had misleadingly suggested in his translation that the 'gates' in 31-day months had significant zodiac signs. Neugebauer stated:

> The translation of *te'emerta zi'ahā* as "its sign" is misleading since it could be taken as a reference to zodiacal signs [Neugebauer's footnote: "So expressly by Charles"] (which do not exist in Enoch's astronomy). The purpose of this remark, however, is to explain that 31 days of the sun's risings in the same gate is indicative for the position of the equinoxes and solstices.[31]

Neugebauer translated the problematic references in the verses *1 En.* 72:13, 19, instead as: "... according to its (the gate's) characteristics (for the season)."[32] In addition, he stressed that the stars were "astronomically insignificant, being nothing but a replica of the division of the solar year. Neither the constellations

28 P.S. Alexander and G. Vermes also rejected Milik's translation for the parallel versions of the Maskil's Hymn, in 4Q256 xix (frag 6a ii) 3, 5; 4Q258 viii (frags 4a ii, 4c–f) 13, ix (frag 5 i) 2, 4, in P.S. Alexander and G. Vermes, eds., *Qumran Cave 4:19, Serekh Ha-Yaḥad and Two Related Texts* (DJD 26; Oxford: Clarendon, 1998), 59–60, 114–119, table 6, 120; 121–124. Albani, *Astronomie und Schöfungsglaube*, 159 n. 20, 211; Albani, "Horoscopes in the Qumran Scrolls," 2:311 n. 98.

29 Tigchelaar and García Martínez, DJD 36, 166, Notes to 4Q209 frag 28 line 9, cf. García Martínez and Tigchelaar, DSSSE 1:439.

30 Drawnel, *Aramaic Astronomical Book*, 199. See also 4Q209, frag 28, line 1, in Section 3.3.2.

31 Neugebauer *'Astronomical' Chapters*, 12: Note to *1 En.* 72: 13, 19.

32 Neugebauer, *'Astronomical' Chapters*, 6–7 (Neugebauer renumbered *1 En.* 72:13 and 72:19b to 72:7c and 7f). Some mss add "because of its sign" in 72: 25b, Nickelsburg and VanderKam, 98 note *f*.

nor the zodiac nor planets are ever mentioned."[33] His position on this issue has been followed by VanderKam,[34] Black,[35] Olson[36] Ben-Dov[37] and Drawnel.[38]

In the 1990s, a group of scholars emerged who were interested in connections between the possible links between the Ethiopic *Book of Luminaries* and 4Q318, though not in terms of applying the zodiac to the Ethiopic chapters. They included Albani,[39] Böttrich, and Glessmer.[40] While agreeing with Neugebauer's view, Albani also concluded that the zodiac in the Ethiopic Astronomical Book "seems to be consciously avoided."[41] He echoed Charles's view that the zodiac was regarded as "heathen" and, had therefore, been replaced by the 'gates.'[42] A similar opinion was taken by Böttrich, who contended that the zodiac is suppressed in the *Book of Luminaries*, in contrast to its open existence in 4Q318 and *2 Enoch*. (He also notes that there is an interest in thunder in both 4Q318 and *2 Enoch*).[43]

The question of the connection between the signs of the zodiac and the heavenly gates has influenced some recent modern translations of the *Book of Luminaries* with regards to the term for 'signs' in *1 En.* 72 as referring to particular 'gates' that correspond to the 31-day months of the summer solstice (Gate 6)

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33 Neugebauer *'Astronomical' Chapters*, 4.

34 J.C. VanderKam, *1 Enoch 2*, 442 and as noted in the next chapter in relation to his in-depth commentary; idem, in Nickelsburg and VanderKam, *1 Enoch 2*, 424, n. 26; idem, "Sources for the Astronomy *I Enoch* 72–82, "in *Birkat Shalom*, 966–967; for a clear summary of the sun and moon in relation to the 'gates,' in the text see, idem, *Calendars in th Dead Sea Scrolls: Measuring Time* (London: Routledge, 1998), 17–27.

35 M. Black, *The Book of Enoch, or 1 Enoch*, 111, 210, 395; idem, *'Astronomical' Chapters*, 39, note to *1 En.* 82:9.

36 Olson, *Enoch: A New Translation*, 137 n. 10: "Black and Neugebauer rightly point out that the Zodiac plays no role in Enochic astronomy"; 142, Note to 72:1: "Notably absent is any astrological interest: there are no references to the Zodiac or the planets."

37 Oral statement, conference *The Dead Sea Scrolls Texts and Contexts*, Birmingham, November 1, 2007; cf. Ben-Dov, *Head of All Years*, 185–187: "the Enochic author who produced the system of gates may have been aware of the zodiacal signs." This view is similar to Milik's.

38 Drawnel, *Aramaic Astronomical Book*, 292–294.

39 M. Albani, "Der Zodiakos," 27–30; Albani, *Astronomie und Schöpfungsglaube*, 83–89.

40 U. Glessmer, "Horizontal Meaning in the Babylonian Astronomical Compendium MUL. APIN and in the Astronomical Book of *1 En*," *Henoch* 18 (1996): 250–282; U. Glessmer and M. Albani, "An Astronomical Measuring Instrument from Qumran," in *The Provo International Conference on the Dead Sea Scrolls* (STDJ 30; ed. D.W. Parry and E. Ulrich; Leiden: Brill, 1999), 407–442.

41 Albani, "Horoscopes in the Qumran Scrolls," 2:316.

42 Albani, "Horoscopes in the Dead Sea Scrolls," 295 n. 57, 316; Albani, *Astronomie und Schöpfungsglaube*, 75–83, 156–60.

43 Böttrich, "Astrologie in der Henochtradition," 233–4, 244–5.

and autumn equinox (Gate 4). Charles translated *te'emerta zi'ahā* in *1 En.* 72:13, 19 as "on account of its sign"[44] and despite Neugebauer's disapproval, Knibb, and Nickelsburg and VanderKam also translated this phrase as "because of its sign."[45] Olson interpreted this part of the sentence as: "in accordance with that which this gate signifies."[46] To date, no evidence has been put forward to offer an alternative, or supplementary interpretation to Neugebauer's argument, nor has Laurence's zodiacal theory been reassessed in recent times in the light of 4Q318.

3.1.2 *The 'Gates' in* 1 En. *72 Reconsidered*

The astronomical data pertaining to the sun, moon, and the 'gates' in *1 En.* 72:2–35 shall now be discussed taking on board almost two centuries of scholarship. The following summary describes the order of the 'gates,' mainly in relation to the seasons and the direction of the sun's annual journey which begins in the spring at the vernal (spring) equinox. The seasons are identified in the text by the lengths of the given ratio of daylight hours to night-time hours (discussed in detail in the next chapter).

The sun's journey begins at **Gate 4** in the East (spring equinox, Month I) (*1 En.* 72:6).

- It then moves north, anti-clockwise, to **Gate 5** (Month II) (*1 En.* 72:11).
- The summer solstice is in **Gate 6** East and West (Months III and IV) (*1 En.* 72:13–17).
- The autumn equinox is also in **Gate 4** in the West (Month VI) (*1 En.* 72:19b–20). The sun travels to **Gate 1** (winter solstices, Months IX and X) (*1 En.* 72:25b–26).[47]
- The sun has completed the chief points on its route," (1 En. 72:2).[48]

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44 Charles, "Book of Enoch," 238; Laurence translates the same verses as "on account of its signs"; his verse numbering is *1 En.* 71. 17, 74, see R. Laurence, *The Book of Enoch the Prophet* (London: Kegan Paul, Trench, 1883), 94–5. Accessed January 9, 2014. Online: https://archive.org/details/bookofenochprophoolaur.

45 M.A. Knibb, *The Ethiopic Book of Enoch* (Oxford: Oxford University Press, 1978), 168–9; George W.E. Nickelsburg and James C. VanderKam, *1 Enoch: A New Translation Based on the Hermeneia Commentary*, 98–9. Some manuscripts also add "because of its sign" in *1 En.* 72:25b. In *1 En.* 72:13 some mss state 30 days, (Nickelsberg and VanderKam, *1 Enoch*," 97, note *c.*) between Months III–IV; *1 En.* 72:19 is between Months VI–VII; there is no mention of a sign for the 31-day month in Month XII (*1 En.* 72:31).

46 Olson, *Enoch*, 144–147; Nickelsburg and VanderKam, *1 Enoch,* 97, 98; Knibb, *The Ethiopic Book of Enoch*, 168–9; Neugebauer, *'Astronomical' Chapters*, 6–7, 12; Charles, "Book of Enoch," 238–239.

47 Neugebauer, "Notes," 50–61.

48 Translation, Nickelsburg and VanderKam, *1 Enoch*, 96–99.

Here the signs are factored in to correspond with the months in the order that they appear in the text. Hence, Month I is cognate with Aries since the year commences with sunrise in Gate 4, "the large gate,"[49] the vernal equinox (*1 En.* 72:6). The 'gate' numbers may be aligned to the zodiac signs and months in the order that they appear in Chapter 72 of the *Book of Luminaries*, as follows:

Gate 4: Aries (Month I) and Virgo (Month VI)
Gate 5: Taurus (Month II) and Leo (Month V)
Gate 6: Gemini (Month III) and Cancer (Month IV)
Gate 1: Sagittarius (Month IX) and Capricorn (Month X)
Gate 2: Scorpio (Month VIII) and Aquarius (Month XI)
Gate 3: Libra (Month VII) and Pisces (Month XII)

When the 'gates' are placed in numerical order, it is apparent that the months in the text run from Gate 1, south (winter solstice), to Gate 6, north (summer solstice) at sunrise at the vernal equinox, as Neugebauer noted.[50] The numerical order of the 'gates' corresponding to the zodiac signs, as suggested in this investigation, describes the sun's movement through the seasons month by month, beginning at the vernal equinox (see Fig. 3.1.2, below).

It should also be noted that the pairs of signs which share same gates are not diagonally opposite signs of the zodiac, as represented in zodiac wheels found in traditional horoscopes and mosaics (that arrangement consists of: Aries opposite Libra; Taurus opposite Scorpio; Gemini opposite Sagittarius; Cancer opposite Capricorn; Leo opposite Aquarius; Virgo opposite Pisces).[51] Instead, the signs are arranged in pairs equidistant from the summer and winter solstices: Aries-Virgo; Taurus-Leo; Gemini-Cancer; Libra-Pisces; Scorpio-Aquarius; Sagittarius-Capricorn.[52]

49 Translation, Nickelsburg and VanderKam, *1 Enoch*, 97.

50 Neugebauer, *'Astronomical' Chapters*, 12 (note to 72:13, 19).

51 Discussed in § 4.3 on diagonal zodiac arrangements known from the early first century writer Manilius and the first century papyrus horoscope from Oxyrhynchus, Egypt, P.Oxy 235.

52 Cf. The system of Ptolemy's parallels suggested by Ben-Dov, *Head of All Years*, 186–7. I found this idea inspiring, though it is not the same as the arrangement in *1 En.* 72.

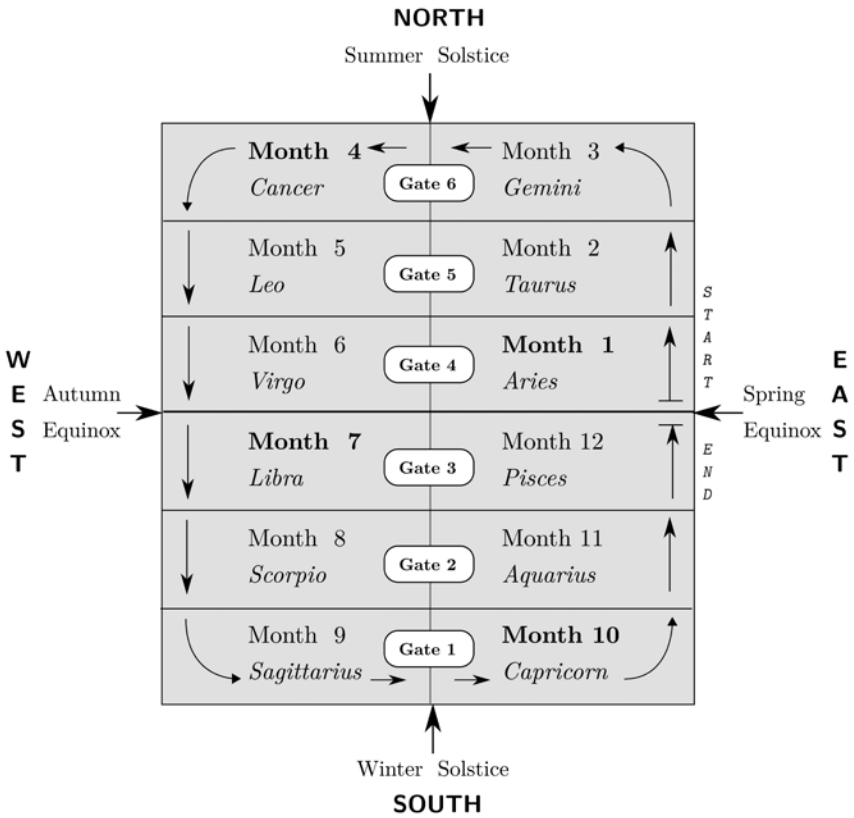

FIGURE 3.1.2 1 En. 72: *The solar journey northwards from the rising sun at the vernal equinox. The numbered gates in which the sun rises and sets have been placed in the centre of the relevant months with corresponding zodiac signs. The solstices and equinoxes are indicated.*[53]

53 I thank Warwick Cope-Williams for sending me this diagram based on reading my unpublished dissertation. See also the diagram by Philip Alexander, which includes the length of day and night ratios, discussed in the next chapter (without the zodiac signs), in P. Alexander, "Enoch and the Beginnings of Jewish Interest in Natural Science," in *The Wisdom Texts from Qumran and the Development of Sapiential Thought* (ed. C. Hempel, et al; Leuven: Leuven University Press, 2002), 243.

In another difficult passage, Charles's translation of *1 En.* 74:5 is as follows:

> In two months the moon sets with the sun: in those two middle portals the third and the fourth. (*1 En.* 74.5)

Charles's problematic comment on this verse is:

> During two months the moon sets with the sun as new moon and as full moon.[54]

This is very unclear as the moon can only set with the sun at conjunction, not at full moon when it is in opposition to the sun. The text must mean that when the sun is in Month I, Gate 4 and Month VII, Gate 3, with the moon, at conjunction, they both set in Aries and Libra, respectively. At full moon, the moon does not set at sunset but at around sunrise. Laurence had interpreted the verse as referring to the full moon and new moon rising and setting in the same part of the sky, which he correctly stated "cannot be the case" because at full moon the moon is "six signs distant from the sun" (that is, astronomically opposite it). Laurence added that the verse refers to when the "sun enters Libra at the autumnal equinox, one only of the signs appropriated to the third gate; and when it enters Aries, at the vernal equinox, one only of the signs appropriated to the fourth gate."

Charles's note to the verse continues, "When the sun is in Aries and Libra the new moon and the full moon are in the third and fourth portals." Here, he may have meant that when the sun is in Aries, Gate 4, the full moon—astronomically opposite it in Libra—sets in Gate 3, and when the sun is in Libra, Gate 3, the full moon opposite it sets in Gate 4, Aries. What is interesting is that Charles here explicitly aligned the 'gates' numerically with the zodiac signs using Laurence's model, albeit without any explanation or attribution, and with some confusion. The muddiness of Charles's zodiacal hypothesis in this context is unlikely to have impressed Neugebauer. One of the key points to be stressed is the fundamental importance of the numbered 'gates' in the Ethiopic *Book of Luminaries* and, consequently, the implications for their presence in the Qumran material, and how they should be interpreted in the Aramaic astronomical texts.

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54 Translation, Charles, *Book of Enoch*, translation and comment to *1 En.* 74:5, p. 240, n. 5. Neugebauer states that the text simply refers to the moon and sun setting at the equinoxes (Gate 3 and 4, the middle 'gates'), presumably at conjunction, Neugebauer, *'Astronomical' Chapters*, 17; VanderKam, *1 Enoch* 2, 440–441, 447.

3.1.2.1. The 360+4 Day Year in the Ethiopic Book

As a side-branch to this investigation of the zodiac, we shall look at some of the textual complexities and later redactions in relation to the length of the different kinds of years described in the Ethiopic *Book of Luminaries* for the sake of completeness.

The text of *1 En.* 72:35 confirms that *1 En.* 72 outlines a 360-day solar calendar of 12 months of 30 days.

> 1 En. 72:35
>
> This is the law of the course of the sun: its return when it returns sixty times and emerges. It is the great luminary which is called the sun forever.[55]

Sixty is one-sixth of 360, the number of degrees in the zodiac; the sun rises and sets in each of the 12 gates, 30 times per month (12 × 30 = 360). The sun enters and exits each gate—two months of 30 days each—sixty times.[56] This passage is not attested at Qumran. Neugebauer commented that the 30-day months may have been "inspired" by the "Babylonian arithmetical schemes" similar to that in the MUL.APIN, or the Egyptian calendar.[57] Due to corruption, some manuscripts (including Tana 9 {15th century}) exclude the number sixty.[58]

In comparison, a 364-day year is presupposed in the main body of *1 En.* 72: there is a 31st day of the month at the two equinoxes and solstices in Gates 4, 3, and Gates 6, 1.[59] These four additional days between the seasons are polemicised in the reckoning of the astronomical year.[60] Scholarly discussion about the status of the four additional days to the 360-day year in the *Book of Luminaries* is extensive and lacks a united consensus.

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55 Translation, VanderKam, *1 Enoch 2*, 417.

56 So, Charles, *Book of Enoch*, 239, Note to *I En.* 72: 35: "sixty times, ie; two months in each portal, one month on his northward and one month on his southward journey. The author disregards for the time being the extra day in the first, third, fourth and sixth portal." (Not in all mss, see below.)

57 Neugebauer, *'Astronomical' Chapters*, 4; VanderKam, *1 Enoch 2*, 428.

58 Neugebauer, *'Astronomical' Chapters*, 13, so, his translation of his text: *1 En.* 72:35: "And this is the rule for the circuit of the sun, when it returns (to the east) and rises (again). This great luminary is called 'sun' for all eternity." (p. 9). The "sixty" version is extant in Charles (BM 485, early 16th century), and Knibb (Rylands Ethiopic MS. 23 {Ryl}, 18th century), Knibb, *Ethiopic Book, 1 En.* 72:35, p. 171; VanderKam, *1 Enoch 2*, 427.

59 *1 En.* 72:13, 19, 25, 31.

60 *1 En.* 75:1–2; 82:5–6.

Conflicting evidence for a 360-day year with an additional day in the months of the solstices and equinoxes in the Ethiopic Book seems to exist in two passages: *1 En.* 82:4–6 advocates adding four days to the 360-day year and it states that people who do not do so are making an error in their calculation of the calendar, therefore the 364-day is the advocated year-length. In an apparent contradiction, *1 En.* 75:1–2 warns that people who add the four extra days of the months at the solstices and equinoxes (the 31st day) are in error—so, apparently the 360-day year should be observed and the four seasonal days not counted in the calendar.[61] Later scholarship discussing what the presumed original Aramaic text might be is far from conclusive. Ben Dov states that the inclusive 364-day year is a redaction, and that the original year was the 360-days with the uncounted but acknowledged four addition seasonal days.[62] Drawnel, in a very brief observation, seems to reach a similar conclusion, based on a possible textual overlap between a passage in the *Book of Luminaries* and a reconstruction of what may possibly be an Aramaic base-text.[63] Stern agrees that the two passages are "inconsistent" and that, "In its present form, *1 Enoch* clearly assumes the 364-day year as normative."[64] Vanderkam suggests that the author of the *Book of Luminaries* consistently advocates a 364-day solar year, not a 360-day one, and that the apparent contradiction is due to the writer speaking from the opponents' point of view.[65] For Neugebauer, also, both verses refer to a 364-day solar year, and *1 En.* 75:1–2 contains "a gloss that intruded into the text"; he also criticised then "modern scholars" for not understanding the Mesopotamian and Greek context of the astronomy.[66]

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61 Frederick Cryer, "The 360-Day Calendar Year and Early Judaic Sectarianism," *SJOT* 1 (1987): 116–122; H.S. Kvanvig, *Roots of Apocalyptic* (WMANT 61: Neukirchen-Vluyn: Neukirchener-Verlag, 1988), 70–1,76; P. Sacchi, "The Two Calendars of the Book of Astronomy," in *Jewish Apocalyptic and its History* (JSPSup 20; trans. W.J. Short; Sheffield: Sheffield Academic Press, 1990), 128–39; G. Boccaccini, "The Solar Calendars of Daniel and Enoch," in *The Book of Daniel: Composition and Reception* (VTSup 83; ed. J.J. Collins and P.W. Flint; Leiden: Brill, 2001), 2: 313–18. These scholars argue that the four epagomenal days are a constituent part of the original Enochic discourse. Albani argues that *1 En.* 72–82 originally describes a 360-day year model, in idem, *Astronomie und Schöpfungsglaube,*, 48–55, 70–75, 155–173.

62 Ben-Dov, *Head of All Years*, 34–37.

63 Drawnel, *Aramaic Astronomical Book*, 394. Drawnel observes that phrase commencing with "And these are the names of the leaders" in *1 En.* 82:10 could correspond with his reconstruction of what could be a similar line in 4Q209 frag 28 5, although he observes that the reconstructed Aramaic textual unit is shorter and differs from the Ethiopic version.

64 Stern, *Calendars in Antiquity*, 194–195.

65 VanderKam, *1 Enoch 2*, 552.

66 Neugebauer *'Astronomical' Chapters*, 9, 19–20 and idem, "Notes," 60.

In a separate context, the 360-day solar year is attested in *1 En.* 74:10a, 11 (cited below); in Neugebauer's view *1 En.* 74:10–17 is another "late addition."[67] The passage describes an intercalary system involving the "sun and the stars" and the moon in which a 354-day lunar year is brought into line with the 360-day solar-stellar year.

> 1 En. 74: 10a, 11
>
> 10a When five years are added up, the total comes to thirty (extra) days for the sun.
> 11 The extra amount for the sun and stars comes to six days; in five years six (extra) days come to thirty days.[68]

In these verses the moon falls behind the "sun and stars" by six days a year. Therefore, it implies a 360-day solar-stellar year and 354-day lunar year: 360 days minus 354 lunar days = –6 days each year. So, the moon will recede against the sun and stars by 30 days in five years, that is, by six days each solar year (6 days × 5 years = 30 days). Undoubtedly, the linking up of the lunar year of 354 days and a solar year of 360 days to create a luni-solar year is of concern to the redactors in this late textual unit. Our question is whether it is possible to excavate a textually corrupt astronomical and calendrical scheme to find the original solar year-length in the Aramaic Astronomical Book, particularly as none of this material from the *Book of Luminaries* exists in the Qumran fragments, *4QAstronomical Enoch*$^{a-d}$. (4Q208–4Q211).

3.1.3 *Ethiopic Computus Treatises and Zodiac Substitution*

Neugebauer's argument against relating the 'gates' in *1 En.* 72 to the sun's and moon's position in the zodiac was, in part, based on data from lunar tables of Ethiopic Computus treatises. We shall now consider the possible correspondence of the 'gates' and zodiac signs in the 354-day lunar year described in these medieval Ethiopic lunar tables now in the Bibliothéque Nationale de France, in Paris. These manuscripts were first published by Sylvain Grébaut in 1919, reanalysed by Neugebauer and incorporated by him in his interpretation of the *Book of Luminaries*.[69]

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67 Neugebauer, *'Astronomical' Chapters*, 18–19.

68 Nickelsburg and VanderKam, *1 Enoch*, 102.

69 O. Neugebauer, "Notes on Ethiopic Astronomy," *Orientalia New Series* 33 (1964): 49–41 (51–58 discusses "The Gates" in the Ethiopic manuscripts on the moon risings and 58–61 is on "The Astronomy of the Book of Enoch").

Neugebauer reconstructed an approximation of lunar Month 1 beginning at the vernal (spring) equinox, stating where the sun and moon rose and set in their 'gates,' based on the solar chapter *1 En.* 72:2–33 and the description of the moon's movements in *1 En.* 74.1–9.[70] He amalgamated this information with Ethiopic manuscripts that detailed the number of days that the moon rose in numbered gates each month in a lunar year of 354 days, Ethiopic MS. 64,[71] and other Ethiopic computus treatises[72] to produce a composite table.

This table presented the number of days in each 'gate' that the moon rises and sets in a 354-day year of alternating 30-day and 29-day months. It showed that the moon rises and sets in Gates 3 and 4 for one or two days, Gates 2 and 5 for two days, and that it can rise and set in Gates 1 and 6, the extreme gates of the solstices for seven or eight days.[73] It is reproduced overleaf (see Table 3.1.3a).

In order to view Neugebauer's reconstructed lunar scheme from a different perspective I have reproduced Table. 3.1.3a in an alternative format. The alternative presentation, Table. 3.1.3b (on p. 277) lists the gate number next to the days of the month, instead of stating the number of days in each month that the moon is said to rise and set in each numbered heavenly gate, as Neugebauer has done.

The resulting format of the Ethiopic Computus Treatises is similar to the formulaic arrangement in *4QZodiac Calendar* and the 'Dodekatemoria Scheme.' Here the gate numbers of lunar risings are in the main grid and can be read off according to the months and days.

At this point, it is possible to assign zodiac signs to the days of the months according to the zodiacal scheme whereby gate numbers are equated with the signs traversed by the sun in *1 En.* 72 as described on pp. 267–270 (See Table. 3.1.3c, on p. 278). In Month 1, days 1 and 2, for example, the Ethiopic lunar

70 Neugebauer, *'Astronomical' Chapters*, 17–19, Table 3.

71 Catal H. Zotenberg, *Catalogue des manuscrits ethiopiens* (*gheez et amharique*) *de la Bibliothéque Nationale* (Paris: Bibliothéque Nationale de France {abbrev. BnF}), 1877, p. 72, MS 64 fols. 4ov–43r; published in text and translation by S. Grébaut, "Table des levers de la lune pour chaque mois de l'année," *Revue de l'Orient Chrétien* 21 (1918–1919): 422–428.

72 Neugebauer, "Notes," 50–3 (Table 1); cf. Neugebauer, composite Ethiopic Computus Treatise, *Ethiopic*, 160; idem, *'Astronomical' Chapters*, 5 n. 2, 18 (Table III), 19 n. 17. Reproduced by Milik, *BE*, 275–278, Table: 278 and by Tigchelaar and García Martínez, "208–209. 4QAstronomical Enoch[a–b] ar: Introduction," DJD 36, 100–101 (Table 20). It has also been reproduced by VanderKam, *1 Enoch 2*, 373–376; 442–444, Table.

73 See "Notes," Table 1, p. 53; hence, Neugebauer's statement that with respect to the Ethiopic astronomical treatises that "the 'gates' of heaven as zodiacal signs is obviously untenable," "Notes," 50, discussed below (see p. 279).

tables state that the moon rises and sets in Gate 4. If Aries replaces Gate 4, we will see that on days 1 and 2 in Month 1 that the moon rises and sets in Aries. If the corresponding zodiac signs replace all the gate numbers, the graph becomes very similar to the pattern of zodiac signs in *4QZodiac Calendar* and the 'Dodekatemoria scheme': all the signs are arranged in their order throughout the months.

TABLE 3.1.3a *Neugebauer's table of Ethiopic Computus Treatises: an approximation of the number of days of the moon's rising and settings in the 'gates,' numbered 1–6, for a lunar year*

Months	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**	**X**	**II**	**XII**	**I**	**Months**
Gates														**Gates**
4	2													**4**
5	2	2												**5**
6	8	8	4	4										**6**
5	2	2	2	2	2									**5**
4	1	1	2	2	1	2								**4**
3	1	1	1	1	1	1	2							**3**
2	2	2	2	2	2	2	2	2						**2**
1	8	7	8	7	8	7	8	7	4	4				**1**
2	2	2	2	2	2	2	2	2	2	2	2			**2**
3	1	1	1	1	1	1	1	1	2	2	1	2		**3**
4	1	1	2	2	1	1	1	1	1	1	1	1	2	**4**
5		2	2	2	2	2	2	2	2	2	2	2	2	**5**
6			4	4	8	8	8	8	8	7	8	8	8	**6**
5					2	2	2	2	2	2	2	2	2	**5**
4						1	1	1	1	1	1	1	1	**4**
3							1	2	2	2	1	1	1	**3**
2								1	2	2	2	2	2	**2**
1									4	4	8	7	8	**1**
2											2	2	2	**2**
3												1	1	**3**
4													1	**4**
Days	30	29	30	29	30	29	30	29	30	29	30	29	30	

TABLE 3.1.3b *Gate numbers of the moon by month and day, according to Neugebauer's table of Ethiopic Computus Treatises (revised format)*

Months	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Days												
1	4	5	6	6	5	4	3	2	1	1	2	3
2	4	5	6	6	5	4	3	2	1	1	2	3
3	5	6	6	6	4	3	2	1	1	1	3	4
4	5	6	6	6	3	2	2	1	1	1	4	5
5	6	6	5	5	2	2	1	1	2	2	5	5
6	6	6	5	5	2	1	1	1	2	2	5	6
7	6	6	4	4	1	1	1	1	3	3	6	6
8	6	6	4	4	1	1	1	1	3	3	6	6
9	6	6	3	3	1	1	1	1	4	4	6	6
10	6	6	2	2	1	1	1	2	5	5	6	6
11	6	5	2	2	1	1	1	2	5	5	6	6
12	6	5	1	1	1	1	1	3	6	6	6	6
13	5	4	1	1	1	2	2	4	6	6	6	6
14	5	3	1	1	1	2	2	5	6	6	6	5
15	4	2	1	1	2	3	3	5	6	6	5	5
16	3	2	1	1	2	4	4	6	6	6	5	4
17	2	1	1	1	3	5	5	6	6	6	4	3
18	2	1	1	1	4	5	5	6	6	6	3	2
19	1	1	1	2	5	6	6	6	6	5	2	2
20	1	1	2	2	5	6	6	6	5	5	2	1
21	1	1	2	3	6	6	6	6	5	4	1	1
22	1	1	3	4	6	6	6	6	4	3	1	1
23	1	1	4	4	6	6	6	6	3	3	1	1
24	1	2	4	5	6	6	6	5	3	2	1	1
25	1	2	5	5	6	6	6	5	2	2	1	1
26	1	3	5	6	6	6	6	4	2	1	1	1
27	2	4	6	6	6	6	5	3	1	1	1	2
28	2	5	6	6	6	6	5	3	1	1	1	2
29	3	5	6	6	5	4	4	2	1	1	2	3
30	4		6		5		3		1		2	

TABLE 3.1.3c *Revised table of Neugebauer's Ethiopic Computus Treatises with zodiac signs corresponding to 'gate' numbers*

Months / **Days**	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
1	4♈	5♉	6♊	6♋	5♌	4♍	3♎	2♏	1♐	1♑	2♒	3♓
2	4♈	5♉	6♊	6♋	5♌	4♍	3♎	2♏	1♐	1♑	2♒	3♓
3	5♉	6♊	6 ♋	6♋	4♍	3♎	2♏	1♐	1♑	1♑	3♓	4♈
4	5♉	6♊	6♋	6♋	3♎	2♏	2♏	1♐	1♑	1♑	4♈	5♉
5	6♊	6♊	5♌	5♌	2♏	2♏	1♐	1♐	2♒	2♒	5♉	5♉
6	6♊	6♊	5♌	5♌	2♏	1♐	1♐	1♐	2♒	2♒	5♉	6♊
7	6♊	6♋	4♍	4♍	1♐	1♐	1♐	1♑	3♓	3♓	6♊	6♊
8	6♊	6♋	4♍	4♍	1♐	1♐	1♐	1♑	3♓	3♓	6♊	6♊
9	6♋	6♋	3♎	3♎	1♐	1♑	1♑	1♑	4♈	4♈	6♊	6♊
10	6♋	6♋	2♏	2♏	1♐	1♑	1♑	2♒	5♉	5♉	6♊	6♋
11	6♋	5♌	2♏	2♏	1♑	1♑	1♑	2♒	5♉	5♉	6♋	6♋
12	6♋	5♌	1♐	1♐	1♑	1♑	1♑	3♓	6♊	6♊	6♋	6♋
13	5♌	4♍	1♐	1♐	1♑	2♒	2♒	4♈	6♊	6♊	6♋	6♋
14	5♌	3♎	1♐	1♐	1♑	2♒	2♒	5♉	6♊	6♊	6♋	5♌
15	4♍	2♏	1♐	1♑	2♒	3♓	3♓	5♉	6♊	6♊	5♌	5♌
16	3♎	2♏	1♑	1♑	2♒	4♈	4♈	6♊	6♋	6♋	5♌	4♍
17	2♏	1♐	1♑	1♑	3♓	5♉	5♉	6♊	6♋	6♋	4♍	3♎
18	2♏	1♐	1♑	1♑	4♈	5♉	5♉	6♊	6♋	6♋	3♎	2♏
19	1♐	1♐	1♑	2♒	5♉	6♊	6♊	6♊	6♋	5♌	2♏	2♏
20	1♐	1♑	2♒	2♒	5♉	6♊	6♊	6♋	5♌	5♌	2♏	1♐
21	1♐	1♑	2♒	3♓	6♊	6♊	6♊	6♋	5♌	4♍	1♐	1♐
22	1♐	1♑	3♓	4♈	6♊	6♊	6♊	6♋	4♍	3♎	1♐	1♐
23	1♑	1♑	4♈	4♈	6♊	6♋	6♋	6♋	3♎	3♎	1♐	1♐
24	1♑	2♒	4♈	5♉	6♊	6♋	6♋	5♌	3♎	2♏	1♐	1♑
25	1♑	2♒	5♉	5♉	6♋	6♋	6♋	5♌	2♏	2♏	1♑	1♑
26	1♑	3♓	5♉	6♊	6♋	6♋	6♋	4♍	2♏	1♐	1♑	1♑
27	2♒	4♈	6♊	6♊	6♋	5♌	5♌	3♎	1♐	1♐	1♑	2♒
28	2♒	5♉	6♊	6♋	6♋	5♌	5♌	3♎	1♐	1♑	1♑	2♒
29	3♓	5♉	6♋	6♋	5♌	4♍	4♍	2♏	1♑	1♑	2♒	3♓
30	4♈		6♋		5♌		3♎		1♑		2♒	

Key: ♈Aries; ♉Taurus; ♊ Gemini; ♋ Cancer; ♌Leo; ♍ Virgo; ♎Libra; ♏ Scorpio; ♐ Sagittarius; ♑Capricorn; ♒Aquarius; ♓ Pisces

As can be seen in Table 3.1.3c, the general pattern in the revised format of the Ethiopic lunar manuscripts with the corresponding zodiac signs is even more similar to that of *4QZodiac Calendar* and the 'Dodekatemoria scheme.' The representation of two zodiac signs by each 'gate' means the signs are arranged in their fixed order, that is, they appear in a sequence running from Aries to Pisces.

The dissonance is that the moon cannot spend one day, or four days in one sign, as it changes signs ideally in just less than 2½ days. The chief reason that Neugebauer rejected the connection between the zodiac and the 'gates' in the Ethiopic astronomical texts was because of this problem. He stated that it was the "customary interpretation" to associate the "gates of heaven as zodiacal signs," but it was "obviously untenable since, eg: the moon can never remain seven or eight days in the same sign, as would be required by our texts if the gates were identical with the signs of the zodiac."[74]

However, the 'gates' represent two zodiac signs, so although the moon spends seven and eight days in one gate, specifically Gates 1 and 6, which equate in our hypothesis to Sagittarius and Capricorn (Gate 1) and Gemini and Cancer (Gate 6), the winter and summer solstices, two signs are involved. Nonetheless, even so, it is true that the moon cannot stay in one zodiac sign for four days (that is, the two zodiac signs with the same gate number for a total of eight days).

It may be argued that the moon's 'gates' in the Ethiopic Computus Treatises appear in their zodiacal order as shown in Table 3.1.3c because of the arrangement of the months and signs in the calendar. Alternatively, the time intervals that the moon spends in each 'gate' may be a very crude schematic arrangement to fit in with the total days of alternating 29-day and 30-day months, in the same way that 4Q318 has a 2-2-3-day recurring pattern and the 'Dodekatemoria scheme' has a 2-2-2-3 day recurring pattern in a year of 12 months of 30 days each. We will return to this idea later in this chapter.

Neugebauer proposed that the 'gates' that were enumerated in Ethiopic MS 64 published by Grébaut and other Ethiopic astronomical texts were "simply sixths of the arc of the horizon" where the sun rose over the course of a year, for the latitude of Lower Egypt or Greece.[75] He continued:

> Nowhere in this scheme is explicit use made of the zodiacal motions of the sun or moon; not even a measurement of arcs in specific units (degrees) is necessary. Thus we are dealing with an extremely primitive level of astronomy which shows no relation to the sophisticated, Babylonian

74 Neugebauer, "Notes," 50.

75 Neugebauer, "Notes," 50–58 (esp. 50 and 57).

> astronomy of the Seleucid period nor to its Hellenistic Greek sequel. Of course no chronological conclusion should be based on such negative evidence for procedures which might well be of local Palestinian origin, uninfluenced by contemporary scientific achievements elsewhere.
>
> In texts obviously influenced by Islamic astronomy, one finds formulations which probably gave rise to the incorrect identification of the "gates" with the zodiacal signs. For example we read in Vat. Aeth 54.7, "The sun rises through the (gate of) Aries (hâmâl) on the 17th of Magâbît (Month VII), that is, the first of spring (rabîʿ) [in the 14th century]. (The sun stays in Aries) 30;43 days" And "On the 17th of Yakâtît (Month VI) the sun rises through the gate of Pisces (ehût)." But this is no more than to say that the sun rises through the same gate as the zodiacal sign of the month in question.[76]

There are two problems with this statement, one, Neugebauer appears to be dismissing the significance of the transmission history of the Ethiopic Computus Treatises in relation to the interpretation of the 'gates' as zodiac signs in the medieval period (as well as by Laurence, Hoffman and Dillman, who Neugebauer had never referenced). Two, the zodiac was designed to work with the months as van der Waerden described, so the alignment of zodiac signs and months would be what one would expect.

A further problem with Neugebauer's treatment of the Ethiopic lunar treatises is that he argues that the data of the 'gates' represent the points on the local eastern and western horizon from which the moon rises and sets are defined by the sun.[77] However, the moon has varied rising and setting points on the horizon each day and while the sun's rising and setting points are clear, predicting where the moon will rise with accuracy is far more complicated. With reference to the Ethiopic *Book of Luminaries*, Neugebauer emphasised, "the concept of the zodiac as a reference system for the solar motion is unknown to the author of the astronomical section. . . . in the Book of Enoch."[78]

The rejection of the zodiacal interpretation of the 'gates' for the sun (and thus, the moon) remains the modern consensus position, as summarised by VanderKam:

> We should recall that for more than a century it was customary to understand the gates of Enochic astronomy as equivalent to the signs of the

76 Neugebauer, "Notes," 58.

77 Neugebauer, "Notes," 52–58.

78 Neugebauer, "Notes," 59–60.

> zodiac. Only when Neugebauer turned his attention to the astronomy in 1 Enoch 72–82 did the meaning of the gates become clear. As he showed, they are "fixed arcs of the horizon, related in a very simple way with the rising-and-setting-amplitude of the sun during the course of one year. [Footnote: "Notes on Ethiopic Astronomy," 50 (=*Astronomy and History*, 468).[79]

Subsequently, Neugebauer's repudiation of the hypothesis that the 'gates' in the Ethiopic lunar manuscripts and in the solar scheme of *1 En.* 72–82 represent the zodiac signs has been applied by scholars in relation to the Aramaic Astronomical Book from Qumran.

It shall be suggested that the 'gates' represent the sun's ideal rising and setting points on the horizon, modifying Neugebauer's model with the addendum that the 30 days (and 31 days at the solstices and equinoxes) when the sun passes from one 'gate' to the next (*1 En.* 72:6–32) is equivalent to the time that the sun takes to traverse one zodiac sign. Hence, the 'gates' correspond to the schematic position of the sun in the zodiac for a month (30 or 31 days) at a time. The solar, zodiacal month that the sun stays in Gate 4, then, would be from about March 21 thereabouts, whenever the spring equinox falls in the calendar, to about April 21. The rising and setting of the sun at the beginning of each sign determines the limits of the 'gates.' This argument only applies to the sun, for which there is archaeological support in the zodiac sundials, discussed in Chapter 4. Our discussion on the moon is different.

In his critical edition of the Qumran astronomical fragments of the Book of Enoch, Milik made a direct connection between MS Eth 64 and the Aramaic astronomical fragments to support his theory of the synchronistic calendar[80] (discussed in the next section):

> For our practical purposes, namely for the interpretation of the fragments of the synchronistic calendar of 4QEnastr, we cite Neugebauer's table I . . . which schematizes the Ethiopic text on the risings of the moon in the successive gates in the course of the year of 354 days.[81]

Interestingly, Neugebauer did not apply his theory of the 'gates' as arcs on the horizon to the Qumran fragments. Vanderkam suggests that there is direct link between the Ethiopic Computus Tables and the *Book of Luminaries*.

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79 VanderKam, *1 Enoch 2*, 442.

80 Milik, *BE*, 273–4.

81 Milik, *BE*, 277.

> The fact that copies of the full pattern with such information exist in Ethiopic manuscripts raises an important question regarding the Book of the Luminaries, which contains only a truncated version of the data.

He asks, "Is the Ethiopic text of *1 Enoch* 72–82 only a condensed form of what was once a much longer Ethiopic or Greek text?"[82] He then connects Neugebauer's work on *1 En.* 72–82 and MS Eth 64 with 4Q208–4Q209 in terms of the commonality of the 'gates':

> According to Eth. MS. 64, the full information came from our book, but only a small part of it is now present in it . . . It should also be noted that the synchronistic calendar in 4Q208–209, as part of its formulaic expressions for the days of the month, records the number of the gate into which the moon enters and from which it exits and provides the dates on which entry and departure occur. As a result, one can determine from it how long the moon remains in each gate.[83]

In contrast, Drawnel draws a distinction between the 'gates' in MS Eth 64, *1 En.* 72–82 and those of 4Q208–4Q211 on textual grounds.[84] This research will show that the 'gates' representing moonrise in the Qumran texts must be zodiacal. It rejects the interpretation of the Ethiopic treatises that the moon's 'gates' signify points on the horizon, due to its shifting celestial latitude. Neugebauer's argument against the lunar 'gates' correlating to zodiac signs must also apply to the changing zones of moonrise on the horizon. As the 'gates' represent two zodiac signs, when the moon is in Gate 1, in Sagittarius and Capricorn, and in Gate 6, in Gemini and Cancer (Table 3.1.3c), the moon spends more time in those 'gates' than it spends it a single 'gate.' For reasons we do not know, the treatises exaggerate the time that the moon spends in a double 'gate,' and shortens some of the time it traverses a single 'gate' to one day. Due to their extreme schematic nature, the treatises cannot be used as a basis to disprove the zodiacal hypothesis concerning the 'gates' in the Aramaic astronomical fragments.

Since the *Book of Luminaries* is so corrupted and abbreviated, it cannot be used as evidence that the moon rises in numbered 'gates' on the horizon in that text either. It is accepted that sun's 'gates' do reflect its rising and setting points on the horizon, however, these also agree with the zodiac signs, as

82 VanderKam, *1 Enoch 2*, 444.

83 VanderKam, *1 Enoch 2*, 444.

84 Drawnel, *Aramaic Astronomical Book*, 292–294; his ideas are discussed in this chapter.

shall be shown from archaeology in the next chapter. The Ethiopic Computus Treatises describe the moon's length of stay in numbered gates on the days of the schematic lunar month (alternating 29 and 30 days), not the sun's 'gates'.

3.2 The Solar and Lunar Months

This study now focuses on establishing a new theoretical construct for 4Q208–4Q209. According to the new theory being put forward in this section the beginning of a solar month may be the start of the sun's journey through a numbered 'gate' that corresponds to a zodiac sign. It would remain in the 'gate' for about 30 days because each sign is 30° wide, with the sun travelling at an ideal 1° per day along the ecliptic. The sun would be mentioned once a solar month in the texts because it enters a 'gate' at the beginning of a zodiac sign."[85] So, in a zodiac calendar charting the movement of the sun and the moon in a 360-day year, a figure based on the number of degrees in the zodiac, the text would mention the sun's rising and setting when it enters the next zodiac sign, that is, a 'gate.' This would be every 30 days, not when the sun rises and sets every day because the sun does not change zodiac signs every day, but every solar month, a solar month being defined as when the sun changes zodiac signs.

The moon's month in this hypothetical model begins at the lunar crescent, that is, after conjunction with the sun in the same 'gate' as the sun. As we've seen in *4QZodiac Calendar* and the encrypted 'Dodekatemoria scheme,' in Chapter 1, Babylonian lunar zodiac calendars use increments of 13° to measure the passage of the moon's daily journey around the earth (less than half a sign per day). Finally, it travels 390° in a schematic synodic month (13 × 30 days).

Unlike those texts, however, in 4Q208–4Q209, the orbit of the moon is represented not in degrees but in two daily fractions presented in units of half-sevenths "shining" in a progressive linear pattern. The double fractions in units of half-sevenths increase and decrease respectively before the full moon and decrease and increase respectively after the full moon. So, fractions during the waxing moon would be: Day *a* (first crescent): 0.5/7ths "shining" and 6.5/7ths "darkness"; Day *b*: 1.7th "shining" and 6/7ths "darkness"; Day *c*: 1.5/7ths "shining" and 5.5/7ths "darkness", and so on, with one element increasing and another element decreasing proportionally (see pp. 293–297).

85 "The sun" שמשא appears in a preserved or semi-preserved state at 4Q208 frag 10a, col i lines 1, 4Q209 frag 6 line 9, 4Q209 frag 7, col iii line 2; 4Q209 frag 7 col iii line 5; 4Q209frag 26 line 3; 4Q209 frag 34 line 2; 4Q209 frag 35 line 2.

The waning moon's fractions of "concealment" start on the day after full moon: Day *x*: 6.5/7ths and 0.5/7ths; Day *y*: 6/.7ths and 1/7th; 5.5/ths and 1.5/7ths, and follow the same pattern as the waxing moon in reverse (see pp. 316–318).[86] The fractions are aligned to the days of the month beginning at the first sliver of the moon after conjunction. The meaning of the fractions, the moon's relationship to the 'gates' and to the sun are matters of scholarly dispute to be discussed.

Milik suggested that the 'gates' were used in the Aramaic astronomical fragments to synchronise a triennial cycle of 354-day lunar years and solar years composed of 364-days.[87] His summary of what he termed the 'synchronistic calendar' is as follows:

> He [the scribe of the *Book of Luminaries*] synchronizes the conjunctions and oppositions of two stars [the sun and moon] by reference to 'gates' from which they rise and in which they set. The synchronism of a lunar year of 354 years (alternately 6 months of 30 days and 6 months of 29 days) and of a solar year of 364 days is effected in a triennial cycle by the addition of an intercalary month: 364 × 3 = 354 × 3 + 30.[88]

He suggested that the ancient copyist did not write out the detailed "description for the second and third lunar years" but "confined himself to some kind of summary."[89] However, there is no reason for the solar years in 4Q208–4Q209 to be structured according to a triennial cycle since the Aramaic Astronomical Book does not reflect the Jubilees-Qumran calendar. No days of the week, no Sabbaths, and no festivals are mentioned and there is no seven-day infrastructure to justify the assumption that a 52-week, 364-day solar year is involved. Milik himself does not explain why a triennial cycle using the Jubilees-Qumran calendar should be necessary for the synchronistic calendar to work.[90] Rather than describing one year of three-year cycle, it is will be argued that 4Q208 and 4Q209 each describe different luni-solar-stellar years in the same cycle.[91]

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86 For a clear outline of the patterns based on examples with translations, see Tigchelaar and García Martínez, "208–209. 4QAstronomical Enoch[a–b] ar: Introduction," DJD 36, 97–99.

87 Milik, *BE*, 274.

88 Milik, *BE*, 274; Tigchelaar and García Martínez, DJD 36, 96.

89 Milik, *BE*, 275.

90 Milik, *BE*, 8, 59–64.

91 Ben Dov is also of the view that the Qumran 'synchronistic calendar' consists of one year only; however, he argues, like Drawnel, that the scheme is not a calendar but a lunar table that tracks lunar visibility throughout the year, having a similar structure and purpose to the Mesopotamian text, Tablet 14 of the *Enuma Anu Enlil* (*EAE* 14), see idem, *Head of All*

Drawnel rejects Milik's hypothesis that the calculation of a triennial cycle is summarised in 4Q208–4Q209, stating, instead, that "the main purpose of the lunar calculation in 4Q208 and 4Q209 is not the synchronism with the solar year, but periods of lunar visibility each month, linked to the computation of lunar light in monthly cycles."[92] He argues that the proportions of fractions in half-sevenths detailed in 4Q208–4Q209 should be understood as daily proportions of time periods involving the moonset and the moonrise during the day and the night in the waxing and waning phases, and not parts of darkness and light on the lunar surface when it waxes and wanes, as understood by Milik, followed by Tigchelaar and García Martínez.[93] His theory is considered in relation to the texts examined in these sections.

We now turn to the number of days and the astronomical structure of lunar and solar months in 4Q208–4Q209. The beginnings and endings of the months are rare and those that exist at all are damaged. If 4Q208 and 4Q209 follow the same pattern as *4QZodiac Calendar* and the 'Dodekatemoria scheme' the months should be synodic, beginning each month on the first lunar crescent, not at the conjunction, or at another lunar phase.

There is some support for this idea in 4Q208 frag 10a col i. The text refers to "all the day," כל יממא [(line 4),[94] a probable reference to the waning moon which appears during the daytime, and is last visible during the daytime. For

Years, 71–72. This study argues, to the contrary, that the scheme is indeed a calendar and not a simply a lunar table (or rather two such lunar tables) without any other function.

92 Drawnel, *Aramaic Astronomical Book*, 299, n. 137.

93 Drawnel argues that verbs that have been variously translated as spatial references to fractions of light and darkness on the moon's surface or the moon's movements, in fact refer to time-related periods of lunar visibility and invisibility, known from the "Lunar Six" in Babylonian astronomy; he argues that the author of the Aramaic Astronomical Book knew the *Enūma Anu Enlil* Tablet 14 and used the same temporal units; for *EAE* 14, see F.N.H. Al-Rawi and A. George. "Enuma Anu Enlil XIV and other early astronomical tables," *AfO* 38–39 (1991–1992): 52–73, see Drawnel, "Moon Computation," 3–42, and idem, *Aramaic Astronomical Book*, 302–307.

94 Drawnel, *Aramaic Astronomical Book*, 92, P1; DJD 36, pl. 3; Dead Sea Scrolls online *4QAstronomical Enoch*[a] (4Q208): PAM No. M-43210 http://www.deadseascrolls.org.il/explore-the-archive/image/B-284658 (Taken in 1960) and PAM M-41399: http://www.deadseascrolls.org.il/explore-the-archive/image/B-298884 (Taken in 1954); see now also the more recent black and white infrared plate (photo taken 2012) of 4Q208 frag 10a, col i labelled "Frag 5," Plate 823, B-366718 http://www.deadseascrolls.org.il/explore-the-archive/image/B-366718 which contains a joined fragment (frag 10b) at lines 2–3.

Tigchelaar and García Martínez the clause "probably stated that the moon was covered all day."[95]

According to Drawnel's theory, the first part of the text prior to the blank line, refers to the last crescent in the waning phase (lines 3–4) and, after the blank line the first crescent in the waxing phase in the new month (lines 6–10) is tabulated and described.[96] Since the publication of his monumental study, part of 4Q208 frag 10a, col. i line 3 has been joined to another fragment on the digitised plate. The new text possibly confirms that the formula before the wide dividing space probably refers to the last sliver of the moon, at half a seventh of light, with six and half sevenths subtracted at the end of a month.[97] Formerly, 4Q208 frag 10a, col. i line 3 read: שביע ובאוינ. . . . "a seventh and then."[98] With the addition of the joined fragment 4Q208 frag 10a line 3 now reads:[99]

4Q208 frag 10a line 3

נה]ורה פלג שביע ובאוינ

li]ght half a seventh and then

The new infrared photo B-366718, show what looks like a supralinear letter, possibly a *tsade*, intersecting the *aleph* of ובאוינ. A deliberate mark at this point could signify the month end. The information in this fragment is damaged; nonetheless it is clear that the description is not formulaic. Tigchelaar and García Martínez note that the text for Day 1 of the new month in 4Q208 fragment 10a, column i, lines 7–10 [not from line 6 which they state describes the last day of the month, see below] shows that "this description was more extensive than that of the other days."[100]

95 Tigchelaar and García Martínez, "208. 4QAstronomical Enoch[a]," DJD 36, 114 (Comment to line 4).

96 Drawnel compares this phase to *1 En.* 73: 4–7c, in Drawnel, *Aramaic Astronomical Book,* 287, and he begins his illustrative reconstructions of the patterns of a full and hollow month with *1 En.* 73:4–8, Drawnel, *Aramaic Astronomical Book,* Appendix IX (Plates and online, as note above).

97 See note 94, above for the link to the online infrared image of 4Q208 "Frag 5" in black and white, B-366718. The link for full spectrum colour, see 4Q208: "Frag 5" Plate 823, B-366717, http://www.deadseascrolls.org.il/explore-the-archive/image/B-366717.

98 See original photos online taken in 1954 and 1960, note above; transcription, Tigchelaar and García Martínez, DJD 36, 113; Drawnel, *Aramaic Astronomical Book*, 92.

99 My transcription and translation.

100 Tigchelaar and García Martínez, DJD 36, 97.

The text refers to the lunar crescent, the fraction of a "half-seventh," (0.5/7th) שביע פלג . . . (line 6, and line 10 reconstructed) following a wide blank line.[101] Tigchelaar and García Martínez, comment that line 6 "seems to be a description of the last day of a month." However, textually and spatially, following the dividing space, line 6 is arguably the first day of a month that begins at first crescent.[102] They reconstruct the beginning of line 6 as:

שתא שביעיא פלג שביע[thus, translating the damaged line with the broken first word as "six-sevenths, one-half of a seventh" to read: 'it [the moon] reigns for the remainder of this day with six-sevenths, one half seventh . . .'[103]

Drawnel restores line 6 as חד[שע] שביעיא פלג שביע[, translating the first two letters as denoting the month number "] the seventh mo[nth] a half of a seventh."[104] However, the infrared image B-366717 shows that the first letter is very clearly a *he* and the second letter is a possible *aleph* and there are no hidden letters between the first and second extant word. Neither reconstruction of this line, therefore, holds up to scrutiny.

In *4QAstronomical Enoch*^{b} (4Q209) a month beginning at the first sliver of the crescent, at 0.5/7th, appears in 4Q209 frag 3 lines 2–8 (mostly restored).[105] The existing text in the broken fragment has progressively increasing fractions from Night 2 of the month at the fraction of 1/7th, therefore, the moon should be 0.5/7th on Night 1 of the month, the first crescent.

It is an established scholarly theory that schematic synodic months are represented as alternate 29 (hollow) and 30-day (full) months in 4Q208–4Q209 and that the full moon occurs on Day 14 of the hollow month, and Day 15 of the full month.[106] This idea is further suggested by 4Q209 frag 26, lines 2–3 (discussed in Section 3.3.1) which refers to the half-lunar year of "[25 weeks and] two [days]" (part-reconstructed with reference to the corresponding Ethiopic text, *1 En.* 79:4). As examined later, this time period may be qualified

101 Drawnel, *Aramaic Astronomical Book*, 92–4 (Table 2.7 and 2.8).

102 Tigchelaar and García Martínez, "208. 4QAstronomical Enoch^{a}," DJD 36, 113–114.

103 Tigchelaar and García Martínez, "208. 4QAstronomical Enoch^{a}," DJD 36, 113–114. My translation of their reconstruction to line 6.

104 Drawnel, *Aramaic Astronomical Book*, 92–93.

105 Tigchelaar and García Martínez, DJD 36, 140–141, Pl. 5; Drawnel, *Aramaic Astronomical Book*, 149–151. Pl. 3. Dead Sea Scrolls online*4QAstronomical Enoch*^{b} (4Q209) Plate 846. PAM M43.235. B-284682 (Taken in 1960): http://www.deadseascrolls.org.il/explore-the-archive/image/B-284682.

106 So Tigchelaar and García Martínez, DJD 36, 97–99, 133, 148; Milik, BE, 282–283, Drawnel, *Aramaic Astronomical Book*, 243, and Appendix I and II, pp. 421 and 424, Drawnel refers to these as Pattern I and Pattern II respectively, Tigchelaar and García Martínez, as Scheme I and II.

by the reference to "177 days": also half of a lunar year of 354 days in alternating 29 and 30-day months.[107] Since "weeks" are probably mentioned in 4Q209 frag 26, lines 2–3 in the context of a 354-day lunar year the authors and users of the Aramaic Astronomical Book of Enoch knew of weeks as calendrical units independently of the "weeks" in the Jubilees-Qumran calendar.

The 29 and 30-day months are not described as such; the lunar fractions end on day 27 or day 28, respectively, as if synodic months are not being described, but, rather schematic sidereal months by which the moon completes its orbit in about 27.3 days and the distance that the earth has moved in the meantime is not included. This situation might be read in 4Q209 fragment 7, column ii, lines 11–13: in this fragment, Month IX could be completed by the moon at the end of the 27th day of the month.[108] The text describes the rising of the waning moon on the 27th night and how its fraction changes until there is just 0.5/7th final visibility during the day (restored). However, in another fragment (4Q209 frag 6+6a, line 9), discussed below, the conjunction between the sun and the moon occurs on the 29th night, as can be calculated on the basis of the existing text.

With regards to the non-extant and part of the surviving text, in 4Q209 frag 6 + 6a, line 9, Milik, and Tigchelaar and García Martínez (who follow Milik), and Drawnel have restored the end of the month differently, based on the material remains and their critical interpretation of the formula in the text.[109] Since the scanty content of the formula of 4Q209 frag 6+6a, line 9, is not attested in any the other Aramaic fragments, the precise reading is open to argument. The surviving writing, following a substantial missing part of the manuscript, is reproduced below with the last words of line 8, which are partially extant.

4Q209 frag 6 + 6a, lines 8–9

8 ..... ערב ועל (*vacat*)
9 (?)ים[(?) מֹ̇א דן כלה ול קיח כל שאר נהורה ונפק גלגלה ריקן מן כֹ̇ל נֹ̇הור מֹ̇טמר עם
שֹ̇[משא][110]

107 See § 3.3.1. for a full discussion.

108 Tigchelaar and García Martínez, DJD 36, 146, Pl. 6; Milik, *BE*, 279, 281, Pl. 25; Drawnel, *Aramaic Astronomical Book*, 145–147.

109 Milik, *BE*, 284; Tigchelaar and García Martínez, DJD 36, 144; Drawnel, *Aramaic Astronomical Book*, 156–159, 297. See also Drawnel, *Aramaic Astronomical Book*, 158, "Notes on the Reconstruction."

110 See digital image online: http://www.deadseascrolls.org.il/explore-the-archive/image/B-284655, PAM Number: M-43207 (Taken 1960) and http://www.deadseascrolls.org.il/

> 8. Sets and rises (*vacat*)
> 9. . . . . this complete d(?)[ay?]. And all the remainder of its light is taken and the disk rises empty of all light, hidden with [the] s[un.] (My transcription and translation)

The description is probably a formulaic sentence that is repeated each month. The lunar disk is poetically described as rising "empty of all light, hidden with the sun."[111] . . . . . ריקן מן כֹל נֹהור מטֹמר עם שֹ[משא], a description of moonrise at conjunction, when the moon has completed its orbit at the end of the month and then has the same longitude on the ecliptic as the sun. At conjunction, the moon rises in the morning at about the same time as the sunrise. The moon cannot be seen because there is not sufficient elongation from the sun in order for it to reflect any fraction of its light. The text is thus describing the moonrise on the morning prior to the first lunar crescent appearing shortly after the sun sets (when the first lunar sliver is visible, constituting one-fourteenth of the moon's light in its waxing phase). Tigchelaar and García Martínez describe 4Q209 frag 6 + 6a as the final days of a "full month"[112] ("full" being 30 days, as opposed to 29 days of a deficient, or hollow month) with the moon on day 30 being invisible.

Drawnel reconstructs the first word of the extant text 4Q209 frag 6a line 9 as, יא[ליל, "the night," interpreting the existing broken first letter as a *yod*.[113] From looking at the high-resolution digital images now at our disposal, Milik's reading that the broken first letter of the first extant word of 4Q209 frag 6a, line 9 is

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explore-the-archive/image/B-284682, PAM Number: M-43235 (Taken 1960). The fragment is joined at the point of אר[ש. (I am, therefore, referring to it as frag 6+6a, not 4Q209, frag 6, as published elsewhere). The larger, right-hand section can be seen online: http://www.deadseascrolls.org.il/explore-the-archive/image/B-298915, PAM Number: M-41369 (Taken 1954).

111 Lit. "empty from all light from being hidden with the sun." מטֹמר, ("hide," 3rd pers. masc. sing, *pael*, passive participle). The reference to emptiness, without the light, appears to be used in the *Book of Luminaries, 1 En.* 73:5, just before the conjunction: the moon is not yet hidden with sun, it still has a fourteenth part of light in its waning phase, "and all its disc is empty, with no light, except its seventh part, one fourteenth part of its light . . ." VanderKam, *1 Enoch 2*, 429, 432–433, 436–439; and *1 En.* 78:14, ". . . and its disc remains empty without light," VanderKam, *1 Enoch 2*, 500, 511. (Nickelsburg and VanderKam, *1 Enoch*, 100–101, 109, as noted by Milik, *BE*, 284, Tigchelaar and García-Martínez, DJD 36, 145; Drawnel, *Aramaic Astronomical Book*, 239–240, 384.

112 Tigchelaar and García-Martínez, DJD 36, 145.

113 Drawnel, *Aramaic Astronomical Book*, 158.

possibly the end of the left side of a *mem* (its thumb), מ̇ים[מא[114] (so Tigchelaar and García Martínez)[115] looks far more plausible than a *yod*.

In Milik's and Tigchelaar and García Martínez's interpretative translation, the disk is dark during the day and then it rises, empty of light, with the sun (at sunrise), and misses out the evening stage. In their reconstruction (Tigchelaar and García Martínez's restoration follows Milik's), the moon sets and rises in its 'gate' before being present in the sky during the day, without any light.[116]

Drawnel disputes Milik's and Tigchelaar and Garcia Martinez's translation on the grounds that the phrase can be compared to the similar expression in *1 En.* 73:5 and *1 En.* 78:14 and that it relates to the conjunction.[117] However, the fact that the conjunction is described in the Aramaic text is not in doubt. Integral to the dispute over the astronomical formula is the reconstruction of the missing text at the beginning of 4Q209 fragment 6 + 6a, line 9. Milik, Tigchelaar and García Martínez reconstructed the beginning of 4Q209 fragment 6a + 6, line 9 (mainly 4Q209 fragment 6a) as follows:

> Reconstruction of missing text from the beginning of 4Q209 frag 6 + 6a, line 9, (in square brackets) by Milik, and Tigchelaar and García Martínez
>
> [לתרעא יא וכסה ימ]מא
>
> [the . . . gate and it is fully covered during the rest of]this day. . . .[118]

Drawnel argues that the blank space at the end of line 8 "makes it clear that there is no mentioning of any gate in the text that follows."[119] His formulaic restoration for this line's missing text for the last day of the lunar month includes the night and excludes the moon's setting and rising in its 'gate' before sunset (see below). Drawnel, who, rejects the hypothesis that there is a regular cosmological presence of the lunar 'gates' (discussed in this chapter), argues against Milik's and Tigchelaar and García Martínez 's reconstruction of לתרעא according to his astronomical thesis, and against their reconstruction of the

114 Milik, *BE*, 284.

115 Tigchelaar and García Martínez, DJD 36, 144.

116 Their formula for the waning moon is at Tigchelaar and García Martínez, DJD 36, 99, lines f and g.

117 Drawnel, *Aramaic Astronomical Book*, 239, n. 3.

118 Milik, *BE*, 284. Tigchelaar and García Martínez, DJD 36, 144.

119 Drawnel, *Aramaic Astronomical Book*, 157 (comment to Line 9).

mem outside the tear, on material grounds.[120] He restores line 9 with 31 characters (almost double the number of his predecessors'), and includes the day of the month in the absent text:

> Reconstruction of missing text from the beginning of 4Q209 frag 6 + 6a, line 9, (in square brackets) by Drawnel
>
> [ובלילא תשעה ועשרין בה כסה כל ליל] יא
> [And during the night twenty-nine it is hidden in it all this ni]ght. . . .[121]

Notwithstanding the different scholarly reconstructions as to whether the night of darkness is included in the count of the days of the month—the matter remains unresolved—all the modern editors agree that it is more probable that the month lengths are ideal synodic 29 and 30-day months in which the final day of the month—the moon's conjunction with the sun when the lunar disk is hidden—and that the lunar fraction which should be seven-sevenths is replaced by a formulaic statement.[122] In 4Q208, the month endings are extant but in such poor condition that the lengths of the months cannot be certain.[123]

3.2.1 *Aligning 4Q209 Frag 7, Col. iii with the Zodiac: Winter Solstice Sunrise*

Having discussed the month lengths in 4Q208–4Q209, this sub-section analyses another important part of the text and engages with current scholarship on the subject before putting forward the evidential basis for a new calendrical hypothesis. The text, *4QAstronomical Enoch*^{b} (4Q209) frag 7, col iii, to be studied in this sub-section, contains the only lunar dates in the Aramaic Astronomical Book in which the sun's astronomical position is also described.

> 4Q209 Fragment 7, Column iii, Lines 1–8[124]

The data in 4Q209 frag 7 col. iii lines 1–8 are the most significant in the Aramaic Astronomical corpus in relation to the basic synchronistic calendar hypothesis.

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120 Drawnel, *Aramaic Astronomical Book*, 158. His alternative theory is discussed on pp. 299–301, 303–304, and again in Section 3.3, and on p. 341.

121 Drawnel, *Aramaic Astronomical Book*, 156–158.

122 See also, Section 3.3.1 on the 354-day year in 4Q209 fragment 26.

123 Tigchelaar and García Martínez, DJD 36, 105–6, Table 1; 113–4; 123, p.l.3.

124 Tigchelaar and García Martínez, DJD 36, 134, 147–148, pl. 6. Milik, *BE*, 279–282, pls. 25–26; Wise, *A New Translation*, 301; Nickelsburg and VanderKam, *1 Enoch*, 100–101 n *n*; Drawnel, *Aramaic Astronomical Book*, 163–165, Plate 4; the digital images in the Leon Levy Dead Sea Scrolls Digital Library are clear: http://www.deadseascrolls.org.il/explore-the-archive/image/B-298915, B-29815, PAM No. M-41369 (image taken 1954); http://www.dead

Milik identified the first date described in *4QEnastr*^{b} (its former sigla) now, *4QAstronomical Enoch*^{b} 4Q209 fragment 7, column iii, lines 1–2 and 5–6 (*BE*, 282–283) as:

> We read here that on the eighth of a month, not otherwise specified, the sun completes its movements on the 'sections' of the first gate and the morning after it rises again from the first gate. This is thus a reference to the end of the 9th solar month and the beginning of the 10th; see *1 En*. 72:25–7. Now, the first day of the 10th solar month, in a year made up of 364 days, falls exactly on the eighth day of the 10th lunar month (the 8th Tebeth) in a lunar year composed alternately of months of 30 and 29 days. Our author described tirelessly, day after day, the phases of the moon during the 12 months.

Tevet is the tenth month in the Hebrew calendar, loosely corresponding to December and January (Tebētu in the Babylonian calendar) in the calendar beginning with Nisan. This date has been repeated by Tigchelaar and García Martínez,[125] and independently reckoned by Michael Wise (although, he has related it to the 364 Jubilees-Qumran calendar, which is unlikely).[126]

It is possible to investigate whether the Qumran Astronomical Book is aligned to an ideal, luni-solar calendar year because the dates, the 8th–9th of the 10th lunar month (8–9/ X), in 4Q209 frag 7, col. iii, lines 1–8 are synchronised with the solar month. During these nights the moon is in an unnumbered 'gate' and the sun completes its paths in Gate 1 (4Q209 frag 7, col. iii, lines 1–2); the moon enters Gate 5 during night 9 (lines 4b and 6b); and the sun travels through its paths (lines 5–6).

The meaning of the cosmological vocabulary is not known and the subject of scholarly discussion. Treating the manuscript as an epigraphic or archaeological, artefact, in *4QAstronomical Enoch*^{b} (4Q209) fragment 7 the start of the sun's month begins in line 1, that is, at the top of col. iii of the sheet (4Q209 frag 7 col. iii lines 1). The composition may, therefore, have a macro-structure, highlighting the beginning of the solar months, or the four quarters of the year, the *tequfot*. In this column, as shall be argued, the text begins at the sunrise of the winter solstice (the *tequfah* of winter).

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seascrolls.org.il/explore-the-archive/image/B-281082, B-281082, PAM Number: M-42235 (image taken 1956); http://www.deadseascrolls.org.il/explore-the-archive/image/B-281082, B-284656, PAM No. M-43208 (image taken 1960).

125 Tigchelaar and García Martínez, DJD 36, 148 (repeated from Milk, *BE*, 282–283).

126 Wise, *The Dead Sea Scrolls: A New Translation*, 301.

Below, is a translation of 4Q209 fragment 7, column iii, lines 1–8 with textual analysis. The text describes the movements of the sun and the waxing moon over the two nights, nights 8 and 9 of the lunar month—the sun and moon are in separate 'gates'; the sun in Gate 1 and the moon in Gate 4 (unnamed on night 8) and Gate 5. Hence, three separate 'gates' are involved in this fragmentary column, one for the sun, and two for the moon. Most of the surviving text of 4Q209 fragment 7, column iii, lines 1–8 includes the eighth and ninth lunar nights (most scholars restore the moon's ninth day that follows its ninth night and the tenth night because there is enough space in the large lacuna to do so at lines 8b–10a. Two letters are extant at the beginning of line 10a, a very clear *shin* and *bet* confirming the probable formulaic reconstruction of the text).[127]

The numerals represent the sequential order of the verses as they actually appear in the manuscript. The square brackets represent restorations in lacunae. There are brief comments to the translation itself in notes, followed by observations, discussion, and details of the alternative theoretical model:

Translation with notes to terms: 4Q209 fragment 7, column. iii, lines 1–8

1 [*vacat* And it (the moon) shines on night eight in]it הֹ[ב[128] four-[se]ve[nths]. And then it (the moon) sets and enters ובאדין ערב ועל.[129] During this night the sun compl[etes]

127 The reconstruction for the missing end of the column, 4Q209 frag 7, col. iii lines 8b–10a would be: 8b) "[and it rules over the rest of this day, two-sevenths. *Vacat*. And it shines on night ten in it (9) five-sevenths. And then it sets and enters. And it is dark the rest of this night two sevenths. And it increases (10) five and half] se[venths]. Reconstructed transcriptions for the entire passage, Milik, *BE*, 279–280, Tigchelaar and García Martínez, DJD 36, 147, Drawnel, *Aramaic Astronomical Book*, 163.

128 L. 1. In the Hebrew Jubilees-Qumran priestly course 4Q324 frag 1, lines 3, 5, בה follows the day of the month, respectively the 14th and 4th (Talmon, DJD 21, 115). Here, line 1 and similarly on line 4, the term connects the day of the lunar month and the moon's fraction. According to Milik and Tigchelaar and García Martínez בה refers to the lunar month itself, meaning "of this month," that is, the 10th lunar month, Tigchelaar and García Martínez, DJD 36, 147,and Milik, *BE*, 281. Drawnel differs, arguing on grammatical grounds that the preposition and pronominal suffix בה refers to the period of time that the moon shines in the night sky "or is absent from it," Drawnel, *Aramaic Astronomical Book*, 247–8.

129 L. 1. The alliterative quality of the *ayin* belongs to the moon's movements ערב ועל (על 3rd person perfect masc. sing, *peal* from עלל "go in") is a verbal word-pair referring the moon's setting and entering its 'gate' whose number is not given. Milik includes in parenthesis in

בליליא דן אשל[מת] 2 שמשא
the passage of all its (lit. 'her') courses חרתיה [130]למהך כל
in the first gate, בתרעא קדמיא and it begins again to go and to come out
ומשרה למתב למתה ולמפק[131]

his translation "(the same gate as before)" to make it clear that the moon is spending a consecutive night in the same 'gate,' Milik, *BE*, 281. Drawnel agrees that the phrase is linked with a 'gate,' *Aramaic Astronomical Book*, 148, Col. C. Table 2.27, § 1, though he states that this is qualified, and not with every moonrise and moonset, op. cit, 249. Greenfield and Sokoloff, translating the verbal phrase as "entered and came in," describe it as Aramaic poetry and prose which is characterised by a "trait, whose source is yet to be established, that two words will often be used instead of a single one.," in J.C. Greenfield and M. Sokoloff, "The Contribution of Qumran Aramaic to the Aramaic Vocabulary," in *Studies in Qumran Aramaic*, ed. T. Muraoka, *Abr-Nahrain Supplement* 3 (1992), 95, 97 (number 52).

130 L.2. This noun has a feminine, plural suffix. The lexeme itself is not attested in another Aramaic scroll. חרת is found in two Hebrew texts from Qumran, (Clines, DCH, 3:325) *4QDamascus Document*[a] (4Q266) frag 11 line 6, as a verb (Qal, passive participle, masculine, singular) meaning *engrave* and *1QThanksgiving Psalms* (Hodayot) (1QH) frag 9 line 26 (formerly line 24), (a feminine noun, singular construct). Milik suggests the nominal form of the verbal root חרת is "to hollow out, to carve, to cut," in cognate languages, Judaeo-Aramaic, Syriac, Hebrew, Mishnaic, Hebrew, Ugaritic and Arabic, and that the verb is similar to the Syriac noun for "fraction." From this he adduces it is related to *1 En*. 72:27, "and the sun has completed the circuit of its sections." He, therefore, translates "... the passage (across) all these sections of the first gate," idem, *BE*, 282, because "section" is closest to that meaning. This translation is accepted by VanderKam in his translation of 4Q209 7 iii in Nickelsburg and VanderKam, *1 Enoch*, 101, and by Tigchelaar and Martinez, DJD 36, 147–8. Drawnel, however, disputes this meaning of the Syriac, and argues that the term in Syriac means "furrow" in relation to the sun's apparent movement during the night before sunrise. He states the word should mean, "'way, path, trajectory, course," in relation to the course of the sun,'" idem, *Aramaic Astronomical Book*, 300. Tigchelaar and García Martínez, DJD 36, 148, and Drawnel comment that Neugebauer states that *1 En*. 72:27, 29 are later glosses (Neugebauer, "'Astronomical 'Chapters," 9) and Drawnel suggests that the Ethiopic texts may be exegeting the Aramaic meaning of חרת, the sun's nocturnal journey (op. cit). Greenfield and Sokoloff propose that the word means "path (?)" and they note the "the meaning of this word and its etymology are uncertain, and that no obvious Aramaic equivalent has been suggested." They dismiss the Syriac "sections" advanced by Milik, as "non-existent," in idem, "Qumran Aramaic," 82 and note 25. Fitzmyer states that כל plus a plural noun with a suffix is attested in biblical Aramaic in Dan 4:34, 5:23, 6:25, J.A. Fitzmyer, *A Wandering Aramean*, Chico: Scholars Press, 1979, 209.

131 L.2. There is word string with a contrasting, alliterative *mem* associated with the sun, שמש. Milik pointed out that the sun's gender is inconsistent. In contrast to the feminine pronominal suffix in "her courses," in the same line, מסרה is the 3rd person masc. singular. participle of שרה, "begin" (the sun is also feminine in 4Q209 frag 35 line 1] ועלת שמשא "the sun enters.", the *pael* perfect 3rd person feminine singular of the root, עלל "enters". It

through these courses. [And then the moon]
3. sets and enters.[132] And it is dark וקבל [133]during the rest of the night three-sevenths. And it increases during this day וקוי בימאי דן[134] four-and-[a-half]-sevenths. [And then]

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is again 3rd person masculine singular in שרי, 4Q209 frag 7 iii, line 5, *pael* perfect of שרה). The other *mem* verbs are *pael* infinitive constructs of תוב, "return," אתה, "come," and נפק, "go out," so three of four the *mem* words in the string are genderless. For Drawnel, the inconsistency of the sun's gender is seriously problematic, *Aramaic Astronomical Book*, see further in Discussion, below.

132 L.3. Milik adds: "(the same gate)"; he means the same gate as the moon was in previously (not the first gate, where the sun is), idem, *BE*, 281. It is possible that this phrase at this point is an accidental repetition from line 1 due to paraplebsis because the moon has already set and entered the "gate," however, the same problem also occurs in line 6 when the moon sets and enters Gate 5 having set and entered Gate 4 in line 5.

133 L.3. Drawnel interprets קבל here to mean the moon's time from moonset to sunrise in the waxing period, Col. D, Table 2.33, p. 165, Table 3.2, 3.3., *Aramaic Astronomical Book*, 238–240. Milik translates it as "wanes," *BE*, 281, which does not convey the correct astronomy (so line 6 and line reconstructed); Tigchelaar and García Martínez translate, "And it is dark," DJD 36, 147. In this translation I am favouring the visual interpretation without ruling out the implications that schematic lunar time intervals were known. In practice, there is little difference between understanding that the moon rises almost an hour later each day—from moonrise at conjunction when the sun rises, to moonset at full moon when the sun rises, and so on, throughout the year—and the corresponding shape of the moon (quarter moon, full moon, and so on). The extent of lunar illumination and darkness can instantly tell us, visually, the day of the lunar month. The days of the months are calendrical elements in the text which may be determined from the extent of the darkness and light on the moon's disk. In another fragment in this manuscript, the shape of the moon from the sun's light is also brought into the equation (see the "like the image of a man," 4Q209 26: 4–5 (cf. *1 En.* 78.17), discussed later in this chapter (§ 3.3.1). It is possible that the date was fine-tuned when the shadows creating the illusion of the "man in the moon" could be seen.

134 L.3. Drawnel interprets קוי to refer here to the time period from sunrise to moonrise, *Aramaic Astronomical Book*, Table 2.33, col. E, p. 165, and from sunrise to moonset when waning, Table 2.32, col. E, pp. 163, 245, 259, translating the verb as "stays". Milik translates it as "waxes," *BE*, 281, and Tigchelaar and García Martínez translate the verb as "increases" (from the *pael* of קוה), The same verb is used for the increasing obscuration of the moon in the waning phase, idem, DJD 36, 97 (Scheme I d), 99 (Scheme II e), see 4Q209, frag 7 col ii, lines 7, 10, an action that occurs also during the day. "Increases" describes the visual experience of the viewer while not detracting from the arithmetic calculation. Greenfield and Sokoloff state that the meaning of the verb in this text is unclear, in "Qumran Aramaic," 84.

4. it goes out נפק [135]and it rules ושלט[136] over the rest of this day two-and-
a-h[al]f-sevenths. *vacat* And it shines on night nine i[n it
ה]ואניר בלילא תשעה ב[137]

135 L.4. For Tigchelaar and García Martínez, נפק means "rises" (from a 'gate'), DJD 36, Scheme I f, p. 94 (waxing), Scheme II e, p. 99 (waning); Milik translates the verb as "emerges" (from a gate), *BE*, 281, and Drawnel interprets the verb as signifying "moonrise" from a "gate," Table 2.33, *Aramaic Astronomical Book* p. 165; he also translates the verb as "it rises." The phrase נפק ושלט (4Q209 7 iii 4; 4Q209 frag 9, line 2; 4Q209 frag 11, line 2) "rises and rules" or "reigns" is a feature only of waxing belonging to the fractions of invisibility; it is echoed by נפק ואניר (4Q209 col. ii lines 4, 7, and others) "rises and shines" in the preceding waning stage which refer to the fractions of visibility (see notes on this phrase in Section 3.2.3).

136 L.4. Drawnel interprets שלט "rule" to mean the time period from moonrise to sunset during the cycle of the waxing moon: Drawnel, "Moon Computation," 19–21, 31 (Table 5), 35 (Appendix 1), and Drawnel, *Aramaic Astronomical Book*, 237–240: Tables, 3.2 and 3.3, col. H. See also 4Q208 frag. 11, line 3, 4Q208 frag. 19, line 6, 4Q208 frag 20, line 1, 4Q209 frag. 9, line 2, 4Q209 frag 11, line 2. He disagrees with the interpretation of "reigns" by García Martínez and Tigchelaar (DJD 36, 98, 98 n. 2) following Milik, *BE*, 282, as referring to the moon ruling with fractions of darkness during the day, and with portions of brightness during the night. Milik translates the phase as "emerges and keeps" (*BE*, 281). In my view, the verb שלט "rule" is probably an inter-textual reference to משל in Gen 1:16, 18 and may be a parallel with Hebrew lunar Qumran calendars that also use this terminology and employ lunar fractions of fourteenths, which is the same as half-sevenths: *4QcryptA Lunisolar Calendar* (4Q317) frag 1+1a col. ii line 7b, and *4QDaily Prayers* (4Q503) frag 7 3b, see H.R. Jacobus, "Qumran Calendars and the Creation: A Study of 4QcryptA Lunisolar Calendar (4Q317)," *JAJ* 4 (2013): 74. Drawnel does not make any comparisons with the textually related Qumran calendar texts. The verb in this manuscript is specific to the fractions of the waxing phase and occurs only in the context of the opposite action to the fractions that "shine" when the moon is increasing. In order to understand the term in the Aramaic Astronomical Book as a time-period, the use of the verb in Hebrew should be compared in 4Q317 and 4Q503.

137 L.4. Drawnel proposes parsing אניר as the perfect *haphel* of the root נהר where the medial *he* has dropped out, as in Samaritan Aramaic (citing, A. Tal, *A Dictionary of Samaritan Aramaic*, Leiden: Brill, 505), or נור from other sources, see *Aramaic Astronomical Book*, 248. The latter is favoured by Abegg et al in DSSEL as the Aramaic 3rd person masculine singular perfect *aphel* of נור meaning "shine" (s.v. 4Q209 frag 7, col iii line 4). Drawnel interprets אניר to refer to the time period from sunset to moonset during the waxing period (that is, at night when presumably when the moon is literally shining), in idem, *Aramaic Astronomical Book*, 31 (Table 5), 35 (Appendix 1) and 238: Table 3.2, Table 3.3, col.B. He does not think that the connection to the day of the month is relevant to the significance of the verb. He states that the expression "on night X" refers to the whole period of nighttime, idem, *Aramaic Astronomical Book*, 247–248. It is interesting that the verb is not coupled with another verb denoting an action but to the day of the month in the lunar calendar. This should occur at sunset because the day, that is the day of the month

5. four-and-a-half-[sevenths]. And then it sets and enters.
During this night the sun begins again to go through [its] course[s, and to set]
בליליא דן שׁרי שמשא למתב ולמתא בחרתׄ[יה ולמערב]
6. through them בהון. And then the [moo]n sets and enters the fifth gate.[138]
ובאדין [שה]רׄאׄ ערׄב ועל לתרעא חמישיא
And it darkens וקבל during the rest of this night by [two-]
7. and-a-half-seve[nths]. And it increases וקוי during this day up to five-sevenths, and its light is equivalent to five-sevenths. [And then it rises]
8. from the [f]if[th] gate . . . מן תׄרעא [ח]מׄיׄ[שיא

Observations

The orality of the text suggests that the similarity of the sound of the moon's words and those of sun's helps to distinguish the textual presence of the two luminaries.[139] On a related note, the repeated ambiguity of the sun's gender in the extant text,[140] as either masculine or feminine, may be a morphological feature, rather than a persistent scribal error since it applies only to the sun. A possible reason for the apparent grammatical inconsistency may be that both the sun and moon are masculine and the author is trying to smooth out any ambiguity in his description of their movements. To illustrate the point, the end of 4Q209 frag 7, col. iii, line 1 is has two optional syntactic links: 1). the moon sets and enters its gate on the same night at moonset, and 2). the sun

number, may begin at sunset. The dates (ordinals of the day of the month) in the formula are given differently in the waxing and waning stages (see analysis of 4Q209, frag 7, column ii in §3.2.3). As Drawnel observes, the opposite of אניר is כסה in the waning period, in *Aramaic Astronomical Book*, 247; however כסה is also used with the date and provides a marker that the month is closing (4Q209 frag 7, col ii, lines 3, 9, 11–12). Therefore, both usages are probably literary calendrical data.

Drawnel argues that the sentence should be read together with his Column D, Moonset to sunrise ("and it is dark during the rest of this night for X," *Aramaic Astronomical Book*, 249–50; here, line 6).

138 L.6. In the zodiac calendar interpretation of the text discussed further in § 3.2.2, it may be suggested that the moon's zodiac sign is listed in the text not at moonset (that is, the first "sets and enters" in line 5) but probably in the longer form, that is, "sets and enters to Gate X" (line 6, Gate 5), which is not the moonset. I suggest that the second use of "sets and enters" with the "gate + X number," in line 6, may be a technical expression to register the zodiac sign. The moon's entrance to the sign can occur at any time during the moon's orbit, day or night, including the period "and it is dark during the rest of this night for X."

139 See note to the alliterative *ayin* and *mem* in lines 1 and 2 above.

140 See note to line 2.

goes through its cosmological processes during the night. Option 1: The preposition and noun "on this night" could close the unit of the moon's section. If so, the sentence would mean that the moon sets and enters its ('gate') "on this night." ערב ועל בליליא דן. This makes sense since the waxing moon sets at night (and rises during the day). The phrase would then harmonise the lunar fraction of four-sevenths with the moon's setting and entering of its 'gate' during the night.[141]

Epigraphically, "on this night" בליליא דן is written on the first line of the column with the lunar material, and "completes" [מת]אשל̈. The last word on the line, could be read as the start of a new narrative unit, that of the sun. Furthermore, in the context of related Hebrew calendrical scrolls from Qumran, in *4Qcryptic LunisolarCalendar* (4Q317), the phrase, "And so it enters the night" וכן תבוא לליל[142] is part of the repetitive formula used for the moonset when the moon is waxing (appearing after the fraction, in fourteenths, for the waxing moon in 4Q317).[143] This phrase in 4Q317 is not dissimilar to, "and then it sets and enters in this night," ובאדין ערב ועל בליליא דן in 4Q209 frag 7, col. iii line 1 where it appears in the formula at a similar point, after the moon's fractions in half-sevenths (the same fraction, mathematically as a fourteenth). If ancient scribes were familiar with the calendar of 4Q317, it is almost impossible not to automatically see Option 1 as the preferred reading.[144]

Option 2: "On this night" בליליא דן alone opens the next clause (So, "On this night the sun completes . . ." instead of, "the moon sets and enters on this night. . . ."); therefore, meaning that the sun's courses are completed during this night, as translated by Milik, Tigchelaar and García Martínez, and Drawnel.[145]

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141 See also T. Muraoka, "The Verbal Rection in Qumran Aramaic," *Studies in Qumran Aramaic*, ed. T. Muraoka, *Abr-Nahrain Supplement* 3 (1992), 113, with reference to 4Q209 frag 7, column iii, line 6, the *lamed* prefixing "the gate" denotes physical movement with a place, "and enters the gate" ועל לתרעא.

142 M. Abegg, "Various Calendrical Texts: 4Q317 (4QcryptA Lunisolar Calendar)," DSSR 4, 58–72. Jacobus, "A Study of 4Q317," 88.

143 "And so it enters the day" is the contrasting formula for the moonset of the waning moon, which sets during the day (it rises during the night). Therefore, the days in 4Q317 begin at moonset, not at sunset.

144 The age of 4Q317 is uncertain (95 per cent probability that the correct age range is 164–93 B.C.E.), see T.A.J. Jull et al., "Radiocarbon Dating of Scrolls and Linen Fragments from the Judean Desert," *Radiocarbon* 37 (1995): 11–19.

145 Milik, Tigchelaar and García Martínez, transcribe the verb "complete" as [מת]אשל̈ on material grounds, Drawnel, as [ת]אשבْ in *Aramaic Astronomical Book*, 162. The digital images are inconclusive. http://www.deadseascrolls.org.il/explore-the-archive/image/B-281082. See Plate 847, B-281082, PAM Number M-42235 (accessed January 23, 2014).

The punctuation favours accepting the consensus interpretative reading of Option 2: there is not a short a syntactical *vacat* after "it sets and goes out in this night" ערב ועל בליליא דן (unlike the similar, repeated formulaic phrase in Hebrew in 4Q317). There is no short *vacat* in line 5 when the sun appears again after this expression, either. In 4Q209 frag 7 col. iii blank spaces are used for major punctuation purposes. The scribe uses a large blank space at line 4b, before the beginning of the next time unit, the ninth night.

In addition, in the previous column, col ii, there is a short blank space after the information about the fraction of the moon's waning. This means that in the formula there is a *vacat* before every instance of the next day of the lunar month (which begins at night): "And on night + number *n*" (number *n* + ובליליא) pertaining to nights 24 to 27, (4Q209 column ii, lines 3 {reconstituted}, 5, 8, 11). The internal consistency of the punctuation is clear. It appears to be argued that בליליא דן "on this night" in 4Q209 frag 7, col. iii, lines 1, 5, should be read as if there were a *vacat* before it. I have accepted this consensus interpretation rather than argue around in circles on the problem.

Discussion

Drawnel examines the references to the sun in 4Q208–4Q209 and argues that they are linguistically different to the lunar text.[146] He claims that this is highlighted in the problem of the inconsistent gender of the sun. He concludes that the solar references are an "intrusion"[147] that add information about the sun's movements during the night, rather than being intrinsically part of a synchronistic calendar.[148] The fact that the solar material appears to be woven in makes calendrical sense, though it is agreed that it seems to have a 'cut and paste' feel to it and certainly the extant text is otherwise only lunar-orientated. Drawnel states:

> There are two occurrences of the word 'sun' that are linked with longer sentences which seem to disrupt the flow of the calculation dedicated to the moon; both of them occur in 4Q209 frg 7 iii (v.v. 1–2, 5–6) . . . The two sentences in 4Q209 frg. 7 iii abruptly begin after the clause ובאדין ערב ועל . . . It is evident that the author of the text wanted to make clear that the moon calculation resumes again. Thus the information about the sun is inserted into the moon section that belongs to nighttime, and more precisely, after moonset . . . The scribe simply added additional

146 Drawnel, *Aramaic Astronomical Book*, 297, 298, 299, 420.

147 Drawnel, *Aramaic Astronomical Book*, 167, 292–301, esp. 298–299, 420, also see p. 72.

148 Drawnel *Aramaic Astronomical Book*, 298–99, n. 137.

information about the movement of the sun during the night when it is invisible on [sic] the sky.[149]

In another fragment the scribe of 4Q209 also used gender fluidity in the feminine of the verb עלל in 4Q209 frag 35 line 1. In this case "the sun enters"]ועלת שמשא[(fem.) rather than ועל (masc.). Here, it also cannot be disputed that the verb is definitely not referring to the moon. The use of the masculine or feminine for the sun might be employed when the scribe thought it was necessary to distinguish between the presence of the two luminaries in their separate, but connected, orbits.

In keeping with his rejection of the synchronistic calendar and his theory that 4Q208–4Q209 is a lunar table interrupted by the sun, Drawnel also rejects Milik's concept of the 'gates.'[150] For Milik, the 'gates' synchronised the sun and moon and are mentioned with a number only (Gate 1, Gate 2, and so on) when the moon or the sun sets and enters, or goes out from a new one. When the 'gate' is not mentioned Milik presupposes that the moon is still entering it at moonset. So, according to Milik's interpretative translation, because the text states that the moon sets and enters Gate 5 during the remainder of night nine, and, rises from it in the day (4Q209 7 iii line 6–8a),[151] the moon must have been in Gate 4 on night eight and the first part of night nine (4Q209 iii 1, 3–5a)—sentences where no 'gate' is mentioned. The alternative would be to take the text literally, so that when no 'gate' is stated, the moon is not in a 'gate' at all. This implies that the text means that the moon only ever stays in a 'gate' for one day only and that would only be whenever it is mentioned. This is not logical (certainly not according to the zodiac hypothesis).

For Drawnel, the 'gates' are not presupposed when they are not mentioned in 4Q208–4Q209 and they are cited only "randomly" in contrast to the scheme of heavenly portals in the Ethiopic *Book of Luminaries*.[152] He observes on grammatical grounds that the formulaic sentences do not seem to be finished when the text simply states that it (the moon) sets and enters . . . "However, it is evident that the 'gates' are cited only sparingly."[153] Some of Drawnel's statements

149 Drawnel *Aramaic Astronomical Book*, 298–299.

150 Drawnel, *Aramaic Astronomical Book,* 298–299, n. 137.

151 Milik, *BE*, 279–81; García Martínez and Tigchelaar, DJD 36, 147–148.

152 Drawnel *Aramaic Astronomical Book*, 293–5, 296–99.

153 Drawnel *Aramaic Astronomical Book*, 296. For a list of fragments in 4Q209 of days of the lunar month, lunar months and the 'gates' on those dates, see Tigchelaar and García Martínez, "4Q209" Table 2, DJD 36, 134–5.

on the alleged problem are cited below because they are given in multiple forms.

> . . . The Aramaic gate references occur quite randomly and do not aim to communication the number of days the moon spends in a gate; rather, they contain additional information concerning the moon in the complex calculation process where the moon illumination and the length of its visibility play the most important role.[154]
>
> The Aramaic texts cite the gates only randomly in the calculation process and do not provide enough information for construing such a detailed monthly, and eventually yearly, scheme found in the *Book of the Revolution*.[155] The Aramaic manuscripts never cite the number of days for moonrise in each gate; their information about moonrise *and* moonset is strictly connected to the division of nychthemeron into periods of moon's visibility and invisibility. Therefore, it is impossible to extract the information about how long the moon remains in a particular gate.[156]
>
> From the computational point of view it would mean that the monthly pattern of lunar visibility would have to cite the moon's gate each time the moon changes the gates from which it rises and into which it sets. The Aramaic manuscripts prove that it is not the case . . . The references to the lunar gates during the rest of the month are randomly cited without any systematic intent.[157]

While it is true that 4Q209 fragment 7 columns ii and iii contain the clearest examples of numbered 'gates' in *4QAstronomical Enoch*$^{a-b}$ (it is the largest fragment) it may be that the ancient composer offered more details on cosmology around the time that the sun entered a 'gate,' elsewhere to distinguish the separate courses of the sun and the moon. As other calendrical scrolls also use a system of abbreviation it may be difficult to argue persuasively that this feature is astronomically significant. I shall now give an example.

The related Hebrew Cryptic A calendrical scroll, 4Q317, also uses incremental linear fractions called "parts," or "divisions" in the construct noun מחלקות,

154 Drawnel *Aramaic Astronomical Book*, 293.

155 Drawnel *Aramaic Astronomical Book*, 294, and see n. 25.

156 Drawnel, *Aramaic Astronomical Book*, 294.

157 Drawnel, *Aramaic Astronomical Book*, 296.

in denominational units of fourteenths.[158] The 4Q317 calendar is aligned with the 364-day Jubilees-Qumran calendar and the days of the week. Yet, only the first day of the schematic lunar month is accompanied by the division of parts (that is, "one part [of 14] is revealed" for the first day of the waxing moon).[159] Thereafter, the number of parts only without the common denominator noun "part"] which is presupposed, is given each day, so (*n* {parts of fourteen} are revealed or hidden):[160] "five/six [parts] are revealed"[161] "eight [parts]...".[162] Similarly, the day of the week is only given at conjunction and full moon ("On the first day of the week");[163] the other days of the week are presupposed and are not noted at all.[164] As it is a practice for some elements of 4Q317 not to be repeated by a scribe after the full formula is given at key points, so the treatment of the 'gates' in the Aramaic fragments could also involve the scribe taking parts of the formula as read until there is a change, as Milik had proposed.

Another comparative Hebrew text that appears to synchronise the lunar phases in fractions of fourteenths with a 364-day calendar is *4QDaily Prayers* (4Q503); however, it must be noted that scholars do not agree on the material reconstruction of this 225-fragment manuscript, nor on the textual restoration.[165] The days begin in the evening; blessings are given for each day of a

158 (4Q317 frag 1+1a line 11 {transcribed in Hebrew} spelled here with a *kaf*, מחלכות), see, M.G. Abegg, "4Q317," DSSR 4, 58; Jacobus, "Qumran Calendars and the Creation," 87, 94.

159 4Q317 frag 1+1a line 11, מחלכות אח[תֹ.

160 Jacobus, "Qumran Calendars and the Creation," 52–3, text: 87–89; text: Abegg, "4Q317," 58, 60.

161 4Q317 frags 1+1a col. ii 17 (transcribed in Hebrew from Cryptic A)...{ה?}תגלה חמש.

162 4Q317 frags 1+1a col. ii 21 (transcribed in Hebrew)...שמנה.

163 4Q317 frags 1+1a col. ii 10 (transcribed in Hebrew) *vacat* באחד לשבת.

164 Jacobus, "Qumran Calendars and the Creation," 55–6.

165 The critical edition is M. Baillet, "503. Prières quotidiennes," *Qumrân grotte 4, III (4Q482–4Q520)* (DJD 7: Oxford: Clarendon, 1982), 104–36; J.M. Baumgarten, "4Q503 and the Lunar Calendar," *RevQ* 12 (1986): 399–407; D.T. Olson, "Daily and Festival Prayers at Qumran," in *The Dead Sea Scrolls and the Qumran Community* v.2, *The Bible and the Dead Sea Scrolls*, ed. J.H. Charlesworth (Waco: Baylor University Press, 2009), 2.301–2, 306–10; the most complete revised edition is D.T. Olson, "4QDaily Prayers (4Q503=4QprQout)" in *Pseudepigraphic and Non-Masoretic Psalms and Prayers*, v.4a of *The Dead Sea Scrolls: Hebrew, Aramaic and Greek Texts with English Translations*, ed. J.H. Charlesworth and H.W.L Rietz (Tübingen: Mohr Siebeck, 1997), 235–85; M.O. Wise, "4Q503," in *The Dead Sea Scrolls: A New Translation*, ed. M. Wise, M. Abegg Jr, and E. Cook (New York: HarperCollins, 2005, repr. 1996), 520–521. Falk suggests a different material reconstruction and restoration in D.K. Falk, Daily, Sabbath and Festival Prayers in the Dead Sea Scrolls, STDJ 27 (Leiden: Brill, 1998), 29–35; F. Garcia-Martinez & E.J.C. Tigchelaar, *The Dead Sea Scrolls Study Edition* (Leiden: Brill, 1998), 998–1007; M.G. Abegg, Jr, "Does Anyone Really Know What Time It Is: A Re-Examination of 4Q503 in Light of 4Q317," in The Provo International Conference on the Dead Sea Scrolls, Technological Innovations, New

30 day month, beginning at sunset, and employ a linear arithmetic progression for several elements with the differing nomenclatures of "flags/ standards," "lots" and "gates" in fractions of light or darkness, or of day or night. Olson suggests that "standards of light" may refer to the "setting and the rising of the sun."[166] Most scholars regard the ordinal number of 'gates' in 4Q503 as corresponding to the number of the day of the month. Olson also states, "the number of 'flags' does not exceed fourteen which would correspond to the number of phases of the moon."[167] If the 'flags' referred to the lunar phases, the nominator of fourteen 'flags' of light or dark could relate to fractions of illumination on the lunar surface, or to moonset and moonrise in relation to sunset and sunrise. Abegg argues that the text begins with the solar month in conjunction with the lunar month,[168] while Schmidt argues that the month begins at 0.25/7th of a crescent.[169] Since Drawnel has not explored how his thesis could apply to related calendrical texts from Qumran, one may add that further avenues of research are suggested in 4Q317 and 4Q503 that may help us understand their fractions of fourteenths and that they could be considered in the interpretation of the lunar fractions in 4Q208–4Q209.

The main bone of contention is that Drawnel does not offer a convincing theoretical model that explains the recurrence of the sun in 4Q208–4Q209, stating only that it is an "intrusion," nor does he offer an argument for the presence of the 'gates' in the text. In asserting that the 'gates' are randomly cited and dismissing Milik's explanation that the 'gates' are mentioned when the luminary concerned moves into the next portal, he does not propose a complete hypothesis that accounts for all the elements in the text. There is simply a circularity of loose ends: the sun and 'gates' do not fit into a lunar table of time periods; therefore, the lunar table of time periods does not accommodate the sun and 'gates.'

Texts and Reformulated Issues, ed. D.W. Parry and E. Ulrich (Leiden: Brill, 199), 396–406; D.K. Falk, "Reconstructing Prayer Fragments in DJD VII," in *The Dead Sea Scrolls Fifty Years their Discovery*, ed, L.H. Schiffman, E. Tov, J.C. VanderKam (Jerusalem: Israel Exploration Society, 2000), 248–255; E.G. Chazon, "The Function of the Prayer Texts: An Analysis of the Daily Prayers (4Q503)," in *The Dead Sea Scrolls Fifty Years their Discovery*, ed, L.H. Schiffman, E. Tov, J.C. VanderKam (Jerusalem: Israel Exploration Society, 2000), 217–225; F. Schmidt, "Le calendrier liturgique des *Prières Quotidiennes* (4Q503)," in *Le Temps et Les Temps dans les literatures juives et chretiennes au tourant de notre ère*, STDJ 112, ed. C.G. Grappe and J.C. Ingelaere (Leiden: Brill, 2006), 55–88; Ben-Dov, *Head of All Years*, 132–39.

166 Olson, "4QDaily Prayers (4Q503=4QprQout)," 235–236.

167 Olson, "4QDaily Prayers (4Q503=4QprQout)," 235–236.

168 Abegg, "Does Anyone Really Know?" 399.

169 Schmidt, "Le calendrier liturgique," Tableau 1, 66.

Furthermore, Drawnel's argument does not clearly explain why, if 4Q208–4Q209 is technically focused on the changing daily time intervals of lunar visibility in relation to moonset and the moonrise, that 4Q209 frag 6 line 9 describes the conjunction in terms of the loss of the "moon's light (נהורה) . . ." (discussed in the previous sub-section). The moon's parts of light and shadow would seem to be of interest, or else this notice at the end of a lunar month would not explain the astronomy, in literal terms, rather than in fractions, to describe the invisible moon on night 29 of a 30-day month. Drawnel also accepts that the moon "shines," a verb connected to lunar illumination, outlined in the comments to the text, above.[170] The fractions of half-sevenths, whether of the illumination of the lunar disk, or the time intervals, are also a function of the day of the lunar month, that is, the date. The day of the month is a repeated daily formulaic element of the lunar calendar (although Drawnel does not think it is a calendar). Since the ends of the months are not extant, we do not know if the date continued when the moon could not be seen.[171] It seems to be certain that the fraction of 7/7ths is not given for the conjunction or the full moon; there may be a question as to whether the reason for this was connected to the significance of the number seven itself.

Finally, Drawnel does not explicate the relationship between lunar time intervals and the moon's linear progression of illumination and de-illumination. The practical difference between measurements of time periods of when the moon can seen as it rises later each day, and the proportions of light and dark when it is waxing, mirrored in the proportion of light and dark of the waning moon, may be moot. As a demonstration, the moon sets at about 50 minutes after sunset on the day after conjunction when it will appear in the early evening as a fine sliver of light. The fraction of half of one seventh, and six and a half sevenths (not extant) in that particular case could conceivably apply to either the time interval, or to the proportion of light and darkness.

To sum up, Milik's original hypothesis that the Aramaic fragments of 4Q208–4Q209 is a schematic sun-moon calendar is a viable basic construct. The synchronistic calendar is a base model that accounts for the sun in the text and the 'gates.' Since Drawnel's theory does not incorporate the elements of the sun and the 'gates' in his lunar model, it is a weaker holistic hypothesis. His valuable contribution does not disprove Milik's theory even if Drawnel is

170 Drawnel, *Aramaic Astronomical Book*, Column A waxing moon, 247; Column B waxing moon, 248, also discussed in note to 4Q209 fragment 7, column iii, line 4b; Column B, waning moon, 258.

171 See further, Drawnel, *Aramaic Astronomical Book*, 287–289.

correct that the solar element is a gloss, or perhaps an addition by another scribe originally. Drawnel's innovative ideas supported by his sensitive linguistic interpretations are a major contribution to our understanding of these texts. His hypothesis has indirectly raised the question as to whether the "divisions" מחלקות in 4Q317 could refer to time periods of lunar visibility, rather than to units of fourteenths of lunar light and darkness. It has also opened up more possibilities for research into 4Q503.

At present, it may be argued, nonetheless, that the two proposed systems: parts of light and dark on the moon's disk and lunar divisions of time, either of which may be measured in fractions of half-sevenths, are compatible, not mutually exclusive. It is very easy to use the moon in a lunar calendar and the moon and stars in a lunar zodiac calendar, where the focus is on the zodiac sign of the moon on days of the month. We can see the moon. We can see when it is the seventh day of a lunar month, for example, by its shape, and tell the date from seeing whether it is waxing and waning. We can also see the moon in the region of zodiacal constellations. Using the basic model of *4QZodiac Calendar* and applying it to 4Q208–4Q209, one can observe and reckon that the phase of moon in the sky agrees with this simple calendrical scheme.

The Case for a Zodiac Calendar in 4Q208–4Q209

By incorporating the key elements of the text, the sun, moon and the 'gates' and the basic idea of the synchronistic calendar of 4Q208–4Q209 in the light of *4QZodiac Calendar* this study proposes a new hypothesis. It focuses on the data within 4Q209 fragment 7, column iii lines 4b–6, in particular the section in which the moon on the ninth day of the lunar month has a fraction of four and a half sevenths "shining" (line 4b) and enters Gate 5 (4Q209 frag 7 col. iii line 6b) and has two and a half sevenths of "dark" (line 6c).

If one substitutes the 'gate' numbers for the zodiac signs according to the proposed scheme in Fig. 3.1.2, which was first put forward by Laurence, Gate 5 is not Taurus. Further, if one includes our knowledge of the primary source zodiac calendars of *4QZodiac Calendar* or the 'Dodekatemoria scheme,' it is possible to look at the connection between either of these schemes and 4Q208–4Q209.

The sequence of days that the moon stays in zodiac signs in the 'Dodekatemoria scheme' is 2 days–2 days–2 days–3 days recurring. In the calendar of 4Q318, the number of days that the moon stays in a sign is 2 days–2 days–3 days recurring. The sun is in Gate 1, Sagittarius-Capricorn (4Q209 frag 7, col. iii, lines 1–2, 5–6) and the moon is in Gate 5 in Taurus waxing on night 9 of the lunar month (4Q209 frag 7, col iii, lines 4b–6). Day 1 of the lunar month (not extant) the moon should be in Gate 1, Capricorn. In Chapter 72 of the *Book*

of Luminaries, Gate 1 is the period of the winter solstice because the length of the night is twice that of the day (*1 En.* 72:26a).[172]

Interpreted zodiacally (see Fig. 3.1.2), the text of 4Q209 frag 7, col iii, may be seen as stating that the sun has completed its journey through Gate 1 West, that is Month IX, (corresponding with Sagittarius) and is about to begin its passage through Gate 1 East, Month X, (Capricorn) and that it is the longest night of the year (*1 En.* 72:26b).The first lunar crescent would be on the first day of this month, Month X.

In order to reach Taurus on Night 9, that is, to enter Gate 5 changing zodiac signs from Gate 4, the moon's sequence of days would fit the 'Dodekatemoria scheme' for Month X. Returning to Table 1.4.1a in Chapter 1, one can see that in Month X *on Day 9 at sunset in the 'Dodekatemoria scheme,' the moon is at 27° Aries* and at *sunset on Day 10 the moon is at 10° Taurus*. Therefore, the moon has changed zodiac signs—'gates'—from Gate 4 to Gate 5 between Day 9 (beginning at sunset) to Day 10 (beginning at sunset).

Milik translated that on Night 8 of the lunar month (4Q209 frag 7, col iii line 1) the moon had set and entered "(the same gate as before)"[173] which would have to be Gate 4 because on Night 9 the moon sets and enters Gate 5 in lines 4b and line 6. The moon then rises in Gate 5 during the ninth day with two-sevenths [and shines during the tenth night, beginning at sunset, with five-sevenths] (4Q209 frag 7, col iii lines 8–[9]).

The diagram on p. 309, Figure 3.2.1, illustrates the hypothesis that the month of 4Q209 fragment 7 column iii contains zodiac signs corresponding to the 'gates', based on the textual remains. Month X, 4Q209 frag 7, col iii is a 29-day lunar month, the extant lunar days 8, 9, and 10 when the moon moves from Gate 4 to Gate 5 passing from Aries to Taurus, and the sun moves through Gate 1, passing from Sagittarius into Capricorn, are highlighted in the diagram.

As it is a 29-day month, the full moon is on Night 14 and the fifteenth morning and the day when the moon can no longer be seen (the 'dark moon') and the conjunction are on the lunar days 28 and 29 (non-extant), in about 21 days' time. (In a 30-day month, the full moon falls on lunar Night 15 and the morning of day 16, Day 29 would be the dark moon, and Day 30, the conjunction.)[174] The days of the sun's month are not shown. At this point in the 354-day lunar year calendar, and in the lunar calendrical month, the moon is about eight

172 The day lengths in *1 En.* 72 are discussed further in §4.4.

173 Milik, *BE*, 297–281.

174 See Drawnel, *Aramaic Astronomical Book*, Appendix I: Full Moon on Day 14, 421–422 and Appendix II; Full Moon on Day 15, 423–424 for useful numerical reconstructions.

days' ahead of the sun.[175] In the surviving text in 4Q209 frag 7, column iii, the sun enters Gate 1 during Night 8 of the lunar month when the moon is at the incremental fraction of 4.0/7ths and the decremental fraction of 3.0/7ths (lines 1–3ab).The sun's month and the moon's month do not begin and end at the same time due to the c.11.25-day discrepancy between the solar and lunar years.

The reconstructed arrangement of lunar and solar days, 'gates' zodiac signs and the increasing lunar fractions for 4Q209 frag 7, col. iii, may be feasibly reconstructed from the existing information, underlined, as follows (the list does not include the accompanying decremental fractions, and the corresponding zodiac signs are additions):

4Q209 frag 7, col. iii. Lunar Month x (Tevet) reconstructed

Days 1, 2, Gate 1-Capricorn, 0.5/7ths, 1.0/7ths
Days 3, 4, Gate 2-Aquarius, 1.5/ths, 2.0/7ths
Days 5, 6, Gate 3-Pisces, 2.5/7ths, 3.0/7ths
Days 7, 8, 9, Gate 4-Aries, 3.5/7ths, 4.0/7ths, 4.5/7ths
Solar Day 1, SUN in Gate 1-Sagittarius to Gate 1-Capricorn on lunar days 8–10
Days 10, 11, Gate 5-Taurus, 5.0/7ths, 5.5/7ths
Days 12, 13, Gate 6-Gemini, 6.0/7ths, 6.5/7ths
Day 14, Gate 6-Cancer FULL MOON
Days 15, 16, Gate 6-Cancer, 0.5/7ths, 1.0/7th
Days 17, 18, Gate 5-Leo, 1.5/7ths, 2.0/7ths
Days 19, 20, Gate 4- Virgo, 2.5/7ths, 3.0/7ths
Days 21, 22, 23, Gate 3- Libra, 3.5/7ths, 4.0/7ths, 4.5/7ths
Days 24, 25, Gate 2-Scorpio, 5.0/7ths, 5.5/7ths
Days 26, 27, Gate 1-Sagittarius, 6.0/7ths, 6.5/7ths
Day 28, Gate 1-Capricorn, DARK MOON
Day 29, Gate 1-Capricorn, CONJUNCTION

Reduced to it constituent parts, as an approximation based on the extant data, Figure 3.2.1, shows the lunar days of the month in the first inner circle;

175 This is a slight revision of Milik's ground-breaking explanation, "We read here that on the eighth of a month, not otherwise specified, the sun completes its movements on the 'sections' of the first gate and the morning after it rises again from the first gate. This is thus a reference to the end of the 9th solar month and the beginning of the 10th; see En 72:25–7. Now, the first day of the 10th solar month, in a year made up of 364 days [disputed in this chapter-HJ], falls exactly on the eighth day of the 10th lunar month (the 8th Tebeth) [sic] in lunar year composed alternately of months of 30 and of 29 days," idem, *BE*, 283.

the days of the month are presupposed to begin at sunset. It can be seen that moon will reach conjunction with the sun in 21 days, and then the next lunar month will begin. The second inner circle contains the 'gates.' In the third inner circle, the corresponding zodiac signs arranged for the moon's movements. The sun takes a month to traverse one 'gate,' Gate 1, Capricorn. The arrangement of the days in twos and threes that the 'gates' correspond to the moon's zodiac signs are: 2 days (1, 2, Capricorn)-2 days (3, 4, Aquarius)-2 days(5., 6, Pisces) -3 days (7, 8, 9, Aries)-2 days (10, 11, Taurus)-2 days (12, 13, Gemini)-3 days (14, 15, 16, Cancer)-2 days (17, 18, Leo)-2 days (19, 20, Virgo)-3 days (21, 22, 23, Libra)-2 days (24, 25, Scorpio)-2 days (26, 27, Sagittarius) and 2 days (28, 29, Capricorn). The arrangement of the 'gates' is very similar to that of the 'Dodekatemoria scheme' for the tenth month. As the 'Dodekatemoria scheme' has 30-day months, the moon spends three days in Capricorn on days 28, 29 and 30. This particular reconstruction of 4Q209 frag 7 col iii, leaves space for the moon to spend two days in Capricorn because the text relates to a 29-day month. After conjunction with the sun, the moon would then move onto Day 1 of the eleventh month, into the zodiac sign of Aquarius (and the month of Shevat). The sun would remain in its 'gate' in Capricorn, for about another nine days after conjunction with the moon before entering Gate 2-Aquarius.

The fourth circle from the centre depicts the moon's phases. There are 28 days of lunar visibility. The fractions are contained in the outermost circle. The fractions on the right side of the outermost wheel represent the waxing phase, taking the incremental fractions from 0.5/7ths (Days 1 to 14) and the on the left side, the waning phase, using the decremental fractions (Days 15 to Day 27). The dark moon is on Day 28 and the conjunction of the moon and sun on Day 29.

The shaded areas indicate: the moon's journey through Gates 4 and 5 in (column iii, lines 4–8) coinciding with its movement from Aries (Gate 4) to Taurus (Gate 5). It rises and shines for 4.5/7ths after sunset in Gate 4 on the evening of Night 9 and sets and enters in Gate 5; it rises in Gate 5 on Day 10 after sunrise. The sun has moved through two 'dark moon' days in Gate 1 (Sagittarius) from the previous month of 30 days (4Q209, frag 7, column ii, in the next subsection) and entered Gate 1 (Capricorn) on the moon's Night 8 (column iii, lines 1–2) and Night 9 (lines 5–6). When it moves into Gate 2-Aquarius after about 30 days in Gate 1-Capricorn, its last days will have been in Gate 1-Capricorn.

As noted earlier, Milik, and García Martínez and Tigchelaar interpret the sun's position (4Q209 frag 7, col iii, lines 1–2, 5–6) to mean that it is rising at the end of the ninth solar month and the beginning of the tenth.[176] The interpretation coincides neatly with the zodiac hypothesis. The idea of a solar month

176 García Martínez and Tigchelaar, DJD 36, 148.

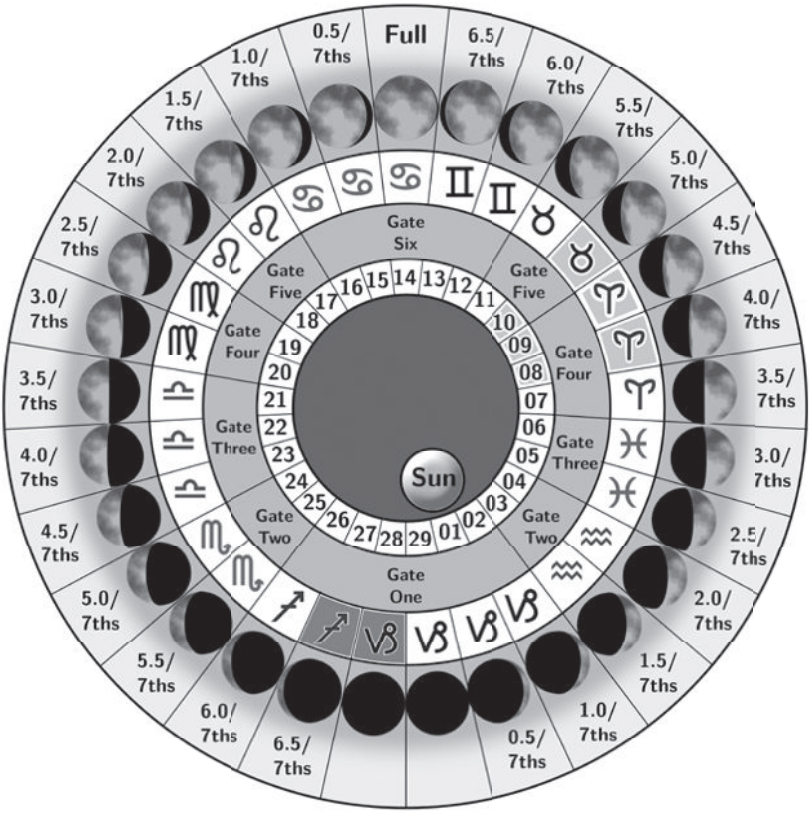

FIGURE 3.2.1 *A possible reconstruction of data in 4Q209 fragment 7, column iii.* Zodiac sign key: Aries ♈; Taurus ♉; Gemini ♊; Cancer ♋; Leo ♌; Virgo ♍; Libra ♎; Scorpio ♏; Sagittarius ♐; Capricorn ♑; Aquarius ♒; Pisces ♓[177]

appears to be an oxymoron and is difficult to understand because months are understood to be lunar and to begin at the first crescent, not at 30-day intervals from the solstices.[178] Since the sun is moving from the end of Sagittarius to the beginning of Capricorn, both of which are in Gate 1, a 'solar month,' it is here argued, is a schematic 'solar zodiac month.' So in this fragment when the sun enters Capricorn at the winter solstice it coincides with the lunar month date 8/Month x ("8 Tevet"), when the waxing moon is eight days' old. For argument's

177 Fig. 3.2.1 was designed to have the sun on the outside of the circle, as it is perceived as going around the earth like the moon. However, it was not possible to execute that for practical design considerations.

178 Drawnel, "Moon computation," 5, Table 1, 35, Appendix 1.

sake, we could state that the winter solstice at around December 21, would be the first day of that solar zodiacal month. The 'solar months,' then, begin when the sun enters or rises in a 'gate,' corresponding to its entering a zodiac sign.

The Babylonian horoscope tablets marked the luni-calendar date of the nearest solstice and equinox, and indeed 8 Tebētu on the winter solstice was one such date.[179] It is possible that one of the purposes of 4Q208 and 4Q209 was to indicate the turning points of the year, the solstices and equinoxes, the *tequfot* in the calendar. As the dates drift in a luni-solar calendar the solstices and equinoxes at the intersection with the lunar calendar may act as calendrical markers. The synchronisation fits the zodiac calendar model and indicates that 4Q208–4Q209 is related to a luni-solar cycle.

Of further interest, as shown in Chapter 1, in *4QZodiac Calendar* the marking of the winter solstice is visible by a blank line before Tevet in the early photographs of 4Q318, col. iv at line 7 (Figures 1–4). The arrangement of text is almost certainly significant. It is suggested that both 4Q209 and 4Q318 should be understood not simply as texts for their literary-documentary content, but as archaeological material documentary manuscripts. In *4QZodiac Calendar*, the other quarters of the year are separated by a blank line (mainly reconstructed).[180] The top of 4Q318 col vii is the full moon of the 10th month, 13, 14 Tevet (extant) and the 12th month of Adar begins at the top of 4Q318 col. vii (extant).

In 4Q209 frag 7 col. iii the sun in line 1, that is, at, the top of the column, begins the tenth solar month and, this research maintains, the winter solstice. It is suggested, therefore, that the Aramaic calendrical texts of *4QZodiac Calendar* and the synchronistic calendar of the Qumran Astronomical Book were both interested in the *tequfot*. These turning points of the year are also specifically mentioned in the literary and poetic texts in the Community Rule, (1QS) col. x, and the Thanksgiving Psalms, (1QH^{a}) col. xx.[181]

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179 See § 1.4.2 reference to the Babylonian Horoscope, Text 8 (BM 36943) in Rochberg, *Babylonian Horoscopes* [*BH*], 78, the winter solstice date is the 8th Tebētu, 251 BCE, corresponding to year 5 in the 19-year cycle of the Uruk scheme. To illustrate the point, Chanukah, Kislev 25, which can also occur around the winter solstice fell on Thanksgiving Day in America, on the fourth Thursday in November in 2013. An intercalation was due in Adar in 2014, and Chanukah in 2013 had fallen behind in the calendar and was early.

180 Nisan (4Q318 col. i) and Tammuz (4Q318 col. iii) begin at the top of a column {reconstructed} and Tishri {part reconstructed} (4Q318 col. iv line 9) and Tevet {reconstructed} (4Q318 col. vi line 8) start after a blank line, corresponding, respectively with the spring, summer, autumn and winter *tequfot*, see Table 1.7.3.

181 See §2.4.2. (They are also features in the Byzantine synagogue zodiacs of Beth Alpha, Sepphoris and Hammath Tiberias, Na'aran and Huseifa, see §1.5 for references).

Finally, it should be noted that in MUL.APIN, the equinoxes and solstices were placed on the 15th day of the luni-solar month[182] (that is, ideally, the day after full moon); the ideal date of the winter solstice in MUL.APIN is 15/ X. If the Aramaic Astronomical Book were a zodiacal calendar, the solstices and equinoxes would be placed at the sun's entry to the zodiac signs at the turning points of the year, at sunrise. This date would not be necessarily at around full moon, unless the two phenomena coincided. Since the sun's entry through Gate 1 at the winter solstice is on Night 8 of the 10th lunar month in the Qumran synchronised calendar, the calendrical scheme in the Aramaic Astronomical Book of Enoch is different to that of MUL.APIN.

Having compared the possible paradigm of 'gates' and cognate zodiac signs in *1 En.* 72–82 with 4Q209 7 iii, I shall now juxtapose this detailed Aramaic fragment with the scheme in *4QZodiac Calendar* in order to examine possible lunar zodiacal correspondences between these calendars.

3.2.2 *The Calendars in 4Q209 Fragment 7, Column iii and 4Q318 Compared*

The data in 4Q209 fragment 7, column iii, lines 1–9 are now compared with details in *4QZodiac Calendar* in the light of the hypothesis that the heavenly 'gates' correspond to the same zodiac signs in the Aramaic and Ethiopic Astronomical Books. The representation of the moon's waxing and waning phases, as given the Aramaic text will be illustrated in tabular form. The phases of the moon in terms of fractions of visibility in relation to the 'gates' and zodiac signs will also be elucidated.

The text states that the waxing moon is 4.5/7ths in Gate 5, Night 9, growing to 5/7ths on Night 10 (4Q209 fragment 7 column iii 4–8) a fraction representing a phase somewhere between a half-moon and a full moon. (3.5/7ths waxing would be the half moon and 7/7ths of waxing, the full moon). The sun progresses through the first gate on Night 8 and on Night 9 (4Q209 frag 7, col. iii lines 1–2, 5–6). It has been shown in § 3.1.2, that Gate 5 is cognate with Taurus and Leo although only one of these signs can be relevant in the calendar at any one point. In 4Q209 frag 7 col. iii the moon rises and sets from Gate 5 (lines 6–8), which may represent Taurus or Leo. At 4.5/7ths it is more than half-way waxing, as explained above. When the sun is between Sagittarius and Capricorn, a Taurus moon would be waxing. If the moon were in Leo when the sun is in Sagittarius and Capricorn it would be waning. Therefore, the moon, because it is waxing, is in Taurus. It is interesting to note that by using the sys-

182 Hunger and Pingree, *MUL APIN*, 72–77, 151–2,163; Brack-Bernsen, "Days in Excess," 7–8; Britton, "Treatments," 23.

tem of 'gates' and lunar phases in fractions of half-sevenths, it is not necessary for the text to state the ordinal number of the month.

In Table 3.2.2a, below, the data in 4Q209 frag 7, col. iii lines 1–8 are arranged in tabular form, correlating the adjacent Gates 4 and 5 with corresponding signs (See Fig. 3.1.2). It states the lunar position in the 'gates' where the numbers in the text are given; I have added the possible zodiac signs.

TABLE 3.2.2a *4Q209. Month 10. Days 8–10*

Day	Sign	4Q209 frag 7, col iii, lines 1–2, 4–9
8	[Aries]	The moon shines on night 8 with 4/7ths light; night; the sun completes the Gate 1 sections. The moon for is dark 3/7ths. No lunar gate number given.
9	Taurus	The moon waxes to 4.5/7ths, it reigns in the day with 2.5/7ths (darkness); it shines on night 9 with 4.5/7ths light; the sun begins again to go through its courses. The moon sets and enters lunar Gate 5 [Taurus]; it is dark for the rest of the night for 2.5/7ths
10	Taurus	The moon waxes to 5/7ths in the day; it rises from lunar Gate 5 [Taurus] in the day; [it reigns over the rest of the day (dark) for 2/7ths; it shines on night 10 with 5/7ths; it is dark with 2/7ths
11	?	Moon waxes to 5.5/7ths]

In Table 3.2.2a, Aries and Gate 4 have been placed in the chart to add a possible context; this alignment presupposes an agreement between the correspondence of 'gate' numbers and zodiac signs in 4Q209 fragment 7 and *1 En*. 72:6–36. The next step is testing the hypothesis that there may be a relationship between *4QZodiac Calendar* and 4Q208–4Q209. According to the reconstructed dates of 4Q318, on nights 8 and 9 of the 10th month, Tevet, the moon is in Taurus, and on nights 10 and 11, in Gemini (Table 1.4.1b). In *4QZodiac Calendar* it is assumed that the days of the month begin at sunset. See Table 3.2.2b.

TABLE 3.2.2b *4Q318 Tevet and 4Q209. Month 10. Days 8–11*

Day	4Q318 sign	4Q209 7 iii 1–2, 4–9
8	Taurus	The moon shines on night 8 with 4/7ths; night; the sun completes the Gate 1 sections; the moon is dark for 3/7ths. No lunar gate number is given.
9	Taurus	The moon waxes to 4.5/7ths, it reigns in the day with 2.5/7ths (darkness); it shines on night 9 with 4.5/7ths; the sun begins again to go through its courses; the moon sets and enters lunar Gate 5 [Taurus]; it is dark for the rest of the night for 2.5/7ths
10	[Gem]]	Moon waxes to 5/7ths in the day; rises from lunar Gate 5 in the day; [reigns over the rest of the day (dark) 2/7ths; shines on night 10 with 5/7ths; dark with 2/7ths
11	[Gem]	Moon waxes to 5.5/7ths]

In Table 3.2.2b, the zodiac sign and day number as they appear in *4QZodiac Calendar* (reconstructed) are compared to the data in 4Q209 fragment 7, column iii.

There is a possible overlap between the zodiacal data in 4Q318 and 4Q209 fragment 7, column iii (=*1 En.* 72:6–36) on Tevet 9 (4Q318) and Night 9 (4Q209 col. iii). It would appear that 4Q209 does not share exactly the same arrangement of the lunar zodiac as 4Q318.

4Q209: On the 9th day of lunar Month X in 4Q209 fragment 7 column iii, line 4b, the moon shines on Night 9 and set and enters the previous 'gate' at moonset (line 5a: "And then it sets and enters"). It changes sign and sets and enters Gate 5 (Taurus) on the 9th (line 6b)—this may not be at moonset but at any point during the moon's nightly journey between moonset and moonrise (line 6b: "And then the [moo]n sets and enters the fifth gate"). It rises from Gate 5 at moonrise (line 7–8). At sunset, lunar night 10th of the month, it shines in Gate 5 (Taurus) (Figure 3.2.1).

4Q318: In *4QZodiac Calendar* on the 8–9 Tevet, the moon is in Taurus; on 10th Tevet the moon is in Gemini; it is presumed that the day begins at sunset. (Table 1.4.1b).

In the 'Dodekatemoria scheme,' on the 8th and 9th of Month X, the moon is in Taurus and on 10th of Month X the moon is in Aries; a sunset day beginning is also presupposed (Table 1.4.1a).

In the Ethiopic Computus Tables: the moon is in Gate 3 (Pisces) on 8/ Month X; in Gate 4 (Aries) on 9/ Month X, and Gate 5 (Taurus) on 10/ Month X (Table 3.1.3c).

The comparative results to Table 3.2.2b for the date 8th–10th Tevet/ Month X in 4Q209 fragment 7, column iii in all the zodiac calendars so far presented is as follows:

> ***Summary of Table 3.2.2.B: the moon's zodiac sign on 8th, 9th, 10th Tevet/ Month x in different zodiac calendars***
>
> 4Q209 FRAGMENT 7, COLUMN III: Night 8th Gate 4? (Aries?) (line 1); Night 9th Gate 4? (Aries?) (line 4b)/ moon sets on the 9th Gate 4? (Aries?) (line 5a); moon sets and enters Gate 5 (Taurus) (line 6); on the 9th the moon rises in Gate 5 (Taurus) (line 7–8); shines in Gate 5 (Taurus) on the 10th
>
> *4QZODIAC CALENDAR*: 8th Taurus, 9th Taurus/ moon changes sign and rises at 27° Gemini on the 10th
>
> 'DODEKATEMORIA SCHEME': 8th Aries, 9th Aries/ moon changes sign from 27° Aries and rises at 10° Taurus on the 10th
>
> ETHIOPIC COMPUTUS TABLES: Pisces, Aries, Taurus

The zodiacal correspondences are in the same or adjacent signs, close enough to be significant. It may be possible to say that the moon's change of sign in *4QZodiac Calendar* and the 'Dodekatemoria scheme' does not take place at sunrise or sunset, as the sun's day varies in length according to the seasons, nor at moonrise or moonset as these times change each day. The Aramaic zodiac calendar of 4Q318 may be a basic, schematic ephemeris that uniformly states the moon's zodiacal position on the ordinal number of the month. The date may begin at sunset as it is in the Babylonian calendar, though this would mean that day lengths are variable. In all the zodiac calendar schemes the moon changes sign during its orbit and the lunar tables in the 'Dodekatemoria scheme' simply log the zodiac degree schematically from Day 1 of the month when the moon will be 13° from the sun, progressing by 13° per day through the 12 zodiac signs of 30° independently of the rising and the setting of the luminaries. The same system can be applied to 4Q318. In the Ethiopic tables, the moon spends one day in each of Gates 3, 4, and 5 on these dates, which although impossible, is mathematically close to the 'Dodekatemoria scheme' and 4Q209.

The 4Q208–4Q209 synchronistic calendar is more complicated than *4QZodiac Calendar*. The text gives the moon's phase, zodiacal sign/ 'gate' and day of the luni-solar month, probably also counting the date from sunset

because the day of the month ordinal is given independently of the information about the moon's rising and setting and its fractions. Unlike the sun's day which changes length over the course of the year, the length of the moon's day changes over the course of a month. The question is whether the lunar fractions signify areas of light and dark, or the moon's time periods in the sky.

Returning to the possible zodiacal calendar, the sun's position in 4Q209 frag 7, col. iii would be 29° Sagittarius—1° Capricorn for the sun (Gate 1) taking the reckoning of the zodiacal degrees from contemporaneous Babylonian or Greek astronomy.[183] The moon's zodiacal position would be Taurus (Gate 5) on the 9th–10th of Month X ("Tevet"). According to this zodiac interpretation, three "columns" are lined up in 4Q209 frag 7, col. iii:

1) The sun's position in the zodiac (Gate 1: 4Q209 frag 7, col. iii, lines 1–2)
2) The luni-solar date (8–10 of [Month X]; Gates 4–5: 4Q209 frag 7, col. iii, lines 1 and line 6)
3) The moon's position in the zodiac (Gate 5: 4Q209 frag 7, col. iii, lines 1 and 6)

183 Steele and Gray have found that in later Babylonian astronomy (based on observations from 179 B.C.E. to 99 B.C.E.) the signs of the zodiac were intended to be of equal length and the boundary of the beginning of the zodiac sign was taken from the first five degrees (0° to 5°) and the boundary for the end of the sign was the last five degrees (25° to 30°) and that this zodiac was sidereal, J.M. Steele and J.M.K. Gray, "A Study of Babylonian Observations Involving the Zodiac," *JHA* 38 (2007): 453–4, 456–7. John Britton dated the introduction of the Babylonian sidereal zodiac to about 400 B.C.E., J.P. Britton, "Studies in Babylonian Lunar Theory: Part III. The Introduction of the Uniform Zodiac," *Arch. Hist. Exact. Sci* (2010) 64: 631–632, 639, 645–6, 649. According to Neugebauer the fixing of the equinoxes and solstices at 0° of the cardinal signs, Aries, Cancer, Libra Capricorn was a Greek innovation, known from Hipparchus (150 B.C.E.) and attested by Euctemon (c. 431 B.C.E.), Callippus (c. 331 B.C.E.) and the calendar of Dionysius (from 285 B.C.E. to c. 241 B.C.E.). He states this norm is "attested nowhere in Babylonian astronomy." In late Babylonian astronomy (c. 300 B.C.E.) the solstices and equinoxes were sidereally fixed (by means of the sun's return to the same star) at the 10th degree ("System A") or at the 8th degree ("System B") of their respective signs. Both norms appear in Greek and Roman sources, in Neugebauer, *HAMA*, 368–69, 593–600, esp. 600; Neugebauer, "The Alleged Babylonian Discovery of the Precession of the Equinoxes," *JAOS* 70 (1950): 1–8; also, Rochberg, *Heavenly Writing*, 128, 131–3. Bowen and Goldstein suggested that the Greek astronomer Meton adopted 0° as the norm for the equinoxes and solstices, following Euctemon, in Bowen and Goldstein, "Meton of Athens," 61.

Roughton et al. found the 0° norm for the vernal equinox in a late Babylonian text "A Late Babylonian Normal and *Ziqpu* Star Text," *Arch. Hist. Exact Sci.* 58 (2004): 542 n. 28; the 0° beginning for the zodiac also underlies early Seleucid sources discussed by Brack-Bernsen and Steele, "Babylonian Mathemagics," 95–121; see also D.J. de Solla Price, *Gears from the Greeks: The Antikythera Mechanism* (TAPS 64:7. Philadelphia: APS, 1967), 18–19 n. 11.

The preceding column to 4Q209 fragment 7 column iii, which details the last days of the waning moon in the previous month, is now examined.

3.2.3 *The Calendars in 4Q209 Fragment 7, Column ii, Lines 2–13*[184] *and 4Q318 Compared*

The column on the right-hand side of the large fragment 4Q209 fragment 7, col. ii follows the same formula as col. iii, but the sun is not mentioned in the column. The dates are days 25 and 26 of the 9th lunar month (Month IX). The existing text 4Q209 frag 7, col. ii, lines 2–13 describes the moon's waning during the month prior to that of 4Q209 frag 7, col. iii.[185] Below is a translation of 4Q209 frag 7, column ii, lines 6–10, followed by a graphic interpretation in which the ordinal numbers of the 'gates' have been substituted for zodiac signs to illustrate possible correspondences. The numerical data are highlighted in bold:

Translation with notes to terms: of 4Q209 fragment 7, columns ii, lines 6–10[186]

6. And **on night twenty-five** of this (month) (the moon) is hidden בה כסה[187] five-sevenths. And there is subtracted ובציר[188] from its light מנהורה five-sevenths.

184 Drawnel, *Aramaic Astronomical Book*, 160–163; Tigchelaar and García Martínez, DJD 36, 145–6; Milik, *BE*, 278–281. See pp. 291–292 n. 124 for the links to the digital photographs on the internet.

185 Tigchelaar and García Martínez, DJD 36, 146; Milik, *BE*, 283.

186 My translation and transliteration, see also, Drawnel, *Aramaic Astronomical Book*, 160–163, 240–243, 255–259. Milik, *BE*, 280–1; García Martínez and Tigchelaar, DJD 36, 145–146, Drawnel, "Moon computation," 36, Appendix 2.

187 Line 6a. Drawnel interprets בה כסה to refer to the period between sunset and moonrise during the waning cycle, in "Moon Computation" 8 (Table 2), Drawnel, *Aramaic Astronomical Book*, Table 2.32, pp. 163, 255–257. Milik translates the verb כסה (*pael*, passive participle) as "is covered" (*BE*, 280–281), so Abegg et al. in the *Dead Sea Scrolls Electronic Library*, Introduction, (2006). Drawnel prefers "to conceal" or "to hide." He argues that this phrase means that the moon is hidden in the sky (that is, it has not yet risen), and not that five-sevenths of the lunar surface is dark, *Aramaic Astronomical Book*, 256. I think one can be more flexible. Here, there are five days left of the month before conjunction. There are five half-sevenths of the moon's "being hidden" to come, increasing at one half-seventh per day. Yet, the time interval between sunset and moonrise is not a mathematically precise regular progression throughout the year. The moon rises later by about 50 minutes each day, but this varies and is not exact. On the other hand, the waning moon's illumination decreases by a constant amount from our perspective: it gets thinner and thinner by equal proportions

7. And then it rises and shines נפק ואניר[189] during the rest of this night two-sevenths. And it increases וקוי during this day up to five-and-a-half sevenths.

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each day. Milik's interpretation seems to me to be the more likely and fits the ideal, schematic formula better, though "hidden" is an improvement on "covered." "Hidden" implies that the encroaching darkness on the waning moon seems to make it gradually disappear. It may work better with the idea that the moon is "empty of all light," meaning being invisible at conjunction, in 4Q209 fragment 6, line 9 (discussed in §3.2). The verb in this context, כסה evokes the shadow that causes the moon to disappear quantified as five-sevenths.

188 Line 6b. According to Drawnel ובציר (4Q209 frag 7, col. ii. 3, 6, 9, 12), (*pael* passive participle of, בצר), "subtract, reduce" (Milik, *BE*, 282) refers to the period of night time in the waning cycle when the moon is not visible, from sunset to moonrise, *Aramaic Astronomical Book*, 160–163, 240–243, 257–258, waning period column F. The verb only occurs in the waning moon period because it describes the opposite process to waxing. Drawnel agrees that the moon's daily diminution refers to the moon's light, 242, 257–8. This daily calculation during the waning period does not serve any direct calendrical purpose except as a possible countdown marker to the end of the month. It may have another function, simply to provide the fullest possible information about the moon's courses. One purpose of the different terminology and phrasing in the formulas for the waxing and waning moon may be to serve as an aid for scribes engaged in the preservation, reconstruction and copying of old manuscripts. Further, in the second half of line 6b the point that the moon is waning with the same fraction, five-sevenths, subtracted from the moon's light, "from its light," מנהורה is repeated as a parallel formulaic rephrasing of the same information from line 6a.

189 The dual action נפק ואניר "rises and shines" only occurs in the formula for the waning moon and is preserved at three points in this column: 4Q209, frag. 7, col. ii, lines 4, 7 and in a separated form at line 10 where the "gate+ the number" is mentioned ("the second gate"). The phrase in which the word-pair is separated at 4Q209 frag 7, col. iii, line 10, suggests that the variant form is the long form and the short form without the "gate + number" implies that the moon rises from the same 'gate' as before, as suggested by Milik in his translation (BE, 280–1). This short, word-pair form is also extant in other fragments where the waning moon's movements are formulaically detailed: 4Q208 fragment 13, line 2; 4Q209 fragment 2, col. ii, line 10; and 4Q209 fragment 5, line 5. Greenfield and Sokoloff translate the phrase as "went out and gave light," and they give it is as an example of Aramaic poetry and prose where two words may be used instead of one.," in "Qumran Aramaic," 95, 97 (number 63). They place this phrase under the sub-heading of "Progressive Action." They add in a note that the longer variant version is an example of "the 'break-up of a stereotyped phrase.'", but, as stated, the longer, variant version is a change in the formula when a "gate + its number" is mentioned. Drawnel claims that the separated form in 4Q209 frag 7, col. ii 10, "And then it rises נפק (from the X gate)" is the moment of moonrise, and, "and it shines ואניר during the rest of this night for X," signifies the moonrise to sunrise, *Aramaic Astronomical Book*, 258. However, the text makes no distinction between the moon's presence in the night sky or day sky. He does not discuss the short form of the phrase.

8. And then it **sets [and] enters** עֹל[ו] ערב **the second gate** and is hidden during the rest of this day to one-and-a-half-sevenths. *vacat.*
9. And **on night twenty-six of this (month)** it is hidden five-and-a-half-sevenths. And there is subtracted from its light five-
10. and-a-half-sevenths. And **then it rises** נפק **from the second gate** and shines ואניר[190] during the rest of this night one-and-a-half-sevenths. And it increases וקוי during this
10–11. day six-sevenths and then it sets and enters . . .

At 4Q209 frag 7, col. ii line 8, the moon sets and rises in the second gate on the 25th day of the 9th month and it rises from the second gate (line 10) during the night,[191] remaining in the second gate on the 25th and 26th.[192] In accordance with the zodiac scheme based on *1En.* 72:2–25, Gate 2 here corresponds Scorpio. Table 3.2.3a tabulates the dates and gate numbers with the correlating zodiac signs.

In the Table 3.2.3a, there are no gate numbers for the 24th of the 9th month in 4Q209 frag 7, col. ii lines 3–5, nor for the 27th of the month (lines 11–13), although Milik interpreted the unnumbered 'gate' through which the moon rises on the 27th to be Gate 2.[193] The suggested zodiac sign and date in this

190 This is the longer, or broken form of the phase with the "gate+ X" in the formula, here the moon is rising from the second 'gate.' It not appear in this form in the waxing stage. Drawnel separates the phrase, *Aramaic Astronomical Book*, Table 3.4, columns G and B, p. 241, to distinguish between what he argues are separate time periods for the waning moon, moonrise, and the moonrise to sunrise. If lunar time periods are meant, then the visible or shining waning moon, אניר, should apply from the moonrise to the moonset since the text does not differentiate between the moon's presence by night and by day. "Night" in the context seems to refer to the period of the moon's visibility as at this stage in its cycle it will be mostly present during the day, not at night. In Babylonian astronomy, moonrise to sunrise is the time period measured at the end of the month when the waning moon can be seen rising for the very last time because it is a fine crescent, not visible in sunlight, to determine the end of the month by observation, see Lis Brack-Bernsen et al., "KUR—When the Old Moon Can Be Seen a Day Later," in *From the Banks of the Euphrates*, ed. M. Ross, Winona Lake: Eisenbrauns, 2008, 1–6. However, at the middle-to-later stages of waning, before it become a fine crescent, the diminishing moon can be seen clearly in the sky in daylight. There is no support from Babylonian astronomy for a daily, schematic lunar time interval of moonrise to sunrise (the period contended by Drawnel) outside of the very end of the month. It seems logical, instead, to interpret this passage as the moon rising from its place against the background of stars in Gate 2, having set in Gate 2 in line 8.

191 García Martínez and Tigchelaar, DJD 36, 102; Milik, *BE*, 283.

192 Milik, *BE*, 281: reconstructed lines 12b and 13.

193 Milik, *BE*, 281, translation, 4Q209 7 ii 12.

fragment are further aligned with corresponding data in *4QZodiac Calendar*, see Table 3.2.3b, below.

TABLE 3.2.3a *4Q209 Month 9. Days 24–27*

Day	Sign	Gates	4Q209 frag 7, col. ii, lines 6–10
24	?	?	No lunar gate mentioned.
25	Scorpio	2	The moon wanes night 25 with 5/7ths darkness; it rises and shines for the rest of the night with 2/7ths of light. It sets and enters Gate 2. It is hidden during the rest of the day by up to 1.5/7ths of its surface.
26	Scorpio	2	Moon wanes night 26 to 5.5/7ths. It rises from the lunar Gate 2 and shines for the rest of the night with 1.5/7ths (light); it wanes during the day, up to 6/7ths. It sets and enters the 'gate.' It is hidden the rest of the day by 1/7th.
27	?	?	No lunar gate mentioned (Milik: Gate 2)

TABLE 3.2.3b *4Q318 Kislev and 4Q209 Month 9. Days 25–27*

Day	4Q318	Gate	4Q209 frag. 7, col. ii, lines 6–10
24	?	?	No lunar gate mentioned.
25	Scorp	2	The moon wanes on Night 25 with 5/7ths darkness; it rises and shines for the rest of the night with 2/7ths of light. It sets and enters lunar Gate 2. It is hidden during the rest of the day up to 1.5/7ths of its surface.
26	Sagitt	1	The moon wanes on Night 26 to 5.5/7ths. It rises from the lunar Gate 2 and shines for the rest of the night with 1.5/7ths; it wanes during the day, up to 6/7ths. It sets and enters. It is hidden the rest of the day by 1/7th.
27	Sagitt	1	No lunar gate mentioned (Milik: Gate 2)

The dates and zodiac sign in 4Q209 fragment 7, column ii, lines 6–8 correspond with *4QZodiac Calendar* on the 25th of the 9th month, Kislev, only. Both

texts agree that on 25 Kislev/ Month IX the moon is in Scorpio (Gate 2). In *4QZodiac Calendar*, the moon is in Scorpio on the 24th and 25th Kislev. In *4QZodiac Calendar*, on 26th and 27th Kislev the moon is in Sagittarius (Gate 1) (Table 1.4.1b), the next sign.

In 4Q209 frag. 7, col. ii lines 10–11, the moon sets and enters Gate 2 (Scorpio) on 25/ Month IX and rises through it on 26/ Month IX (it would probably be in Gate 3 on the 23rd and 24th, Libra, however the first clear date is on the 24th at line 6).

In the 'Dodekatemoria scheme' the moon is in Libra (Gate 3) on 25/Month IX (not in agreement with 4Q209 frag. 7, col. ii, line 6) and in Scorpio (Gate 2) on 26/Month IX (in agreement) (Table 1.4.1a).

In the Ethiopic Computus Tables, the moon rises in Gate 2 (Scorpio) on 25 and 26/ Month IX (Table 3.1.3c).

In sum, then, the following is a comparison of the zodiac calendars for 25 and 26 of Month IX (Gate 2) (=Kislev in *4QZodiac Calendar*), the extant data in 4Q209 fragment 7, column ii:

Summary of Table 3.2.3b: the waning moon's zodiac sign on 25th, 26th, Kislev/ Month IX in different zodiac calendars

4Q209 7 FRAG 7, COL II, LINES 6–10: Scorpio (moonrise, lines 6–7), Scorpio (moonrise, lines 9–10)

4QZODIAC CALENDAR: 25° Scorpio, 8° Sagittarius (at moonset)

'DODEKATEMORIA SCHEME': 25° Libra, 8° Scorpio (at moonset)

ETHIOPIC COMPUTUS TREATISES: Scorpio, Scorpio

The Ethiopic Computus Treatises agree with 4Q209 on these dates. By factoring in the moon's setting and rising in the 'gates,' the editors of 4Q209, Tigchelaar and García Martínez observed that in 4Q209 fragment 7, column ii, the Ethiopic manuscript data run one day ahead of the Aramaic fragment and in 4Q209 fragment 7, column iii, the Ethiopic data run one day behind the 4Q209 text.[194]

These tests have looked at the 'gate' numbers and zodiac signs to test the hypothesis that 4Q208–4Q209 is a zodiac calendar that is related to *4QZodiac Calendar*. The connections are all close by having days in adjacent signs, yet

194 Tigchelaar and García Martínez, "208–209. Astronomical Enoch[a–b] ar: Introduction," DJD 36, 102.

not exact. The difference between the texts cannot be explained by the more refined timing in 4Q209: the waning moon on 26/ Month IX will have risen in Gate 2 (Scorpio) much later than at sunset,[195] when in *4QZodiac Calendar* the moon would be in early Sagittarius (Gate 1). Since there is an overlap on the zodiac signs for 25 Kislev/ Month X, *4QZodiac Calendar* is possibly about one day ahead of 4Q209, that is, not a whole sign ahead, but part of one. The 'Dodekatemoria scheme' is about one day behind. Out of the four clear dates with 'gates' in 4Q209 fragment 7, columns ii and iii, therefore, both *4QZodiac Calendar* and the 'Dodekatemoria scheme' corresponded with two each. A fragment of the less well preserved Aramaic Astronomical Book, 4Q208, is studied in the next sub-section.

3.2.4 *4Q208 Fragment 24, Column i, Lines 1–8*[196] *and 4Q318 Compared*

The dating of 4Q208 is uncertain and there are widely different estimates as to its age. These range from Milik's paleographical estimation of the fragments as pre-Maccabean, dating from the late third century B.C.E. or early second century B.C.E.,[197] to varying estimates of radio-carbon dating. Jull et al. give a 95 per cent probability for a date between 192–86 B.C.E.,[198] close to Milik's figure, whereas Carmi estimates a 98 per cent probability that the date of 4Q208 has a much later and a wider range, 120–55 B.C.E.[199] García Martínez and Tigchelaar suggest that 4Q208 may consist of the synchronistic calendar only, without an introduction, and that the surviving fragments contain Months III–VI.[200]

The text, 4Q208 fragment 24, column i, lines 1–8, retains a description of the moon entering Gate 4 (corresponding with Aries or Virgo in the *1 En.* 72: 6–36 scheme) in line 3 on the second day of a month, line 1 (reconstructed).[201] García Martínez and Tigchelaar suggest that the ordinal "the fifth" חֲמשא[, in line 7 may refer to the sun's rising on the last day of the fourth "solar month possibly through Gate 5 on the 5th solar month."[202] Their conclusion would agree with data in *4QZodiac Calendar*: on the second day of Av (Month V) [Gate 5], the

195 The moon is moving towards conjunction with the sun on the 26th of the month, and rises in the morning.

196 García Martínez and Tigchelaar, DJD 36, 106.

197 Milik, *BE*, 7.

198 A.J.T. Jull et al., "Radiocarbon Dating of Scrolls and Linen Fragments from the Judaean Desert," *Radiocarbon* 37:1 (1995): 11–19.

199 I. Carmi. "Radiocarbon Dating of the Dead Sea Scrolls," in *The Dead Sea Scrolls: Fifty Years After their Discovery* (ed. L.H. Schiffman, et al. Jerusalem: IES, 2000), 881–8.

200 Tigchelaar and García Martínez, DJD 36, 105.

201 Tigchelaar and García Martínez, DJD 36, 124–5; Drawnel, *Aramaic Astronomical Book*, 118–120.

202 Tigchelaar and García Martínez, DJD 36, 125.

moon is in Virgo [Gate 4] (see Table 1.1.3). In Month V/ Av, the sun would rise in Leo [Gate 5]. In contrast, Drawnel reconstructs the line as an incremental lunar fraction, משא[ה[, f]ive-[sevenths.[203] Since there is so little of the text, no firm conclusions can be drawn, but the possible correspondence between the zodiac signs and 'gates' in 4Q208 frag 24, col. i and *4QZodiac Calendar* on Day 2 of Month V is noted.

In sum, the above survey has offered support for the possibility that the heavenly 'gates' in the Aramaic Astronomical Book may correlate with the rising and setting points of the luminaries in zodiac signs. *4QZodiac Calendar* focuses on the moon's schematic entry into 13 zodiac signs in 30-day months. The moon's entry into the signs occurs at different points of the day or night and the calendar may be used in a crude way to tell the reader its position probably at a schematic sunset time.

In the 4Q208–4Q209 synchronistic calendar the dates are specified astronomically by: a) the number of the 'gate,' b) the day (of the lunar month), and c) the lunar phase in mirroring proportions of half-sevenths during waxing and waning. We do not know if the Aramaic Astronomical Book operates in a similar way as the Ethiopic Computus Treatises. Since some fragments do not mention 'gates,' it is possible that it does, meaning that the moon can stay in the same 'gate' for a long time, as it does at the solstices in Gates 1 and 6. Where the 'gates' do appear in 4Q209 and have been translated into correlative zodiac signs in this study, there is an overlap with the signs with 4Q318 running one day ahead, as might be expected given that *4QZodiac Calendar* is probably an ephemeris for an intercalary year.

The research suggests that 4Q209 frag 7 col. iii contains a probable reference to the winter solstice when the sun changes signs (from Sagittarius to Capricorn) within Gate 1 in a similar synchronised lunar calendar, to that identified by Milik (to be investigated further in this chapter). It was agreed with *1 En.* 72.2 that the 'gates' of the moon are the same as the 'gates' of the sun, based on the correlations between 'gates' and the zodiac signs. The moon can be seen in its 'gates,' that is, in the zodiac, against the stars at night. (The sun's 'gates' can be correlated to fixed points of rising and setting on the horizon at different times of the year (proposed by Neugebauer) and the zodiac (disputed by Neugebauer), as attested archaeologically in the Greco-Roman zodiac sundials and astronomical instruments examined in the next chapter). It was further accepted on textual grounds that the calendrical lunar months are schematically 29 and 30 days' long. In the next section we will examine further evidence

203 Drawnel, *Aramaic Astronomical Book*, 119, Drawnel argues the *ḥet* cannot be seen, which is the case in the digital images, now 4QEnoch[a] Frag 4. Plate 814. B-366647 http://www.deadseascrolls.org.il/explore-the-archive/manuscript/4Q208-1, idem, 120.

for a 354-day lunar year in 4Q209 and for the length of the solar year in fragments of 4Q209 outside the formulaic synchronistic calendar.

3.3 The Solar and Lunar Years

As stated in the previous section, Milik did not prove that the synchronistic calendar functioned with a three-year cycle. Due to the fragmentary remains, the length of the synchronised luni-solar year is not known. Albani showed that on a material, textual and mathematical basis Milik's description of the synchronistic year comprising a triennial cycle of 364 days was not sustainable. He suggested that it was more likely that 4Q208–4Q209 described an ideal luni-solar 360-day calendar scheme, like 4Q318 (his point).[204] What this means is that in a 360-day ideal calendar synchronised with lunar months and years, the moon will slip behind the sun in the calendar and so the calendar would require intercalation, rather than the schematic lunar year being aligned with the fixed 364-day calendar the scheme that is probably found in the Hebrew calendar from Qumran calendar, *4QcryptA Lunisolar Calendar* (4Q317), which does not mention the sun. The main question, however, is whether the synchronistic calendar of 4Q208–4Q209 has a solar-stellar year of 360 days, the number of degrees in the zodiac. If so, the moon's year of 354-days would slip behind the sun and stars by six days a year. In five years it would require one 30-day month to be added onto it (6 days × 5 years = 30 days) to stay aligned with the solar-stellar calendar of 360 days.

> Thus: the lunar year over 5 years plus 1 month is 354 × 5 = 1770 + 30 = 1800 days
> This is equivalent to five 360-day solar-stellar years, 360 × 5 = 1800 days.

With regards to 4Q208–4Q209, the 360-day calendar may be variously referred to as the solar-stellar year, the solar year, an ideal year or the luni-solar year, or luni-solar calendar because the sun's position is explicitly mentioned in the text and the lunar months are separate. The sun is not mentioned in 4Q318, and nor are there 29 and 30 day months or a calendar of 354 days with which it is synchronised.

Ben-Dov also reasons that it is unlikely that the Aramaic Book supports the triennial cycle described by Milik; however, he postulates that it describes a single lunar year of 354 days only.[205] He does not offer an explanation as

204 Albani, *Astronomie und Schöpfungsglaube*, 79–83 (esp. 82–83).

205 Ben-Dov, *Head of All Years*, 132.

to how the one single year would be a lunar year of 354 days given that the sun also exists in the text. Drawnel's earlier hypothesis, before his monograph, was that the Aramaic Astronomical Book synchronised a lunar year of 354 days with "a solar year composed of 364 days (*1 En.* 74:10–17),"[206] . . . "or more."[207] According to Neugebauer *1 En.* 74:10–17 was redacted in the Greco-Roman period[208] and is a gloss; it is not extant at Qumran. Drawnel's new critical edition of 4Q208–4Q211 supercedes his former position and he does not now think that a synchonistic calendar is represented in 4Q208–4Q209.[209] We will now turn to further evidence for the length of the lunar year in the literary segments of 4Q209 before investigating the length of the solar year.

3.3.1 *The 354-Day Year in 4Q209 Frag 26*

The 354-day lunar year is implicit in statements in the *Book of Luminaries* which have correspondences with *4QAstronomical Enoch*^{b} (4Q209) fragment 26. This sub-section discusses the lunar year in the literary layers of 4Q209 fragment 26 in separate steps as there are two questions raised in the text: lines 2 and 3a, on the length of the lunar year, and line 3b, on the issue of intercalation with the sun.

4Q209 frag 26, lines 2 and 3a,b

2 [ ]בתרעא שתיתיא בה[
3a [שבעין חמש ועשרין וי] ומין תרין .3b ומחסר מן דבר שמשא[[210]

206 Drawnel, "Moon Computation," 32.

207 "Some Notes on the Scribal Craft and the Origins of Enochic Literature," *Henoch* 31.1 (2009): 68.

208 Neugebauer, *'Astronomical' Chapters*, 18–19.

209 Private communication. Milik's hypothesis of the synchronistic calendar, as stated above is rejected in a footnote, in Drawnel, *Aramaic Astronomical Book*, 299, n. 137.

210 Restoration of broken text, García Martínez and Tigchelaar, DJD 36, 163–164, Pl. 7. Transcription from digital plate online: http://www.deadseascrolls.org.il/explore-the-archive/manuscript/4Q209-1 accessed December 23, 2013. http://www.deadseascrolls.org.il/explore-the-archive/image/B-284657 (PAM M-43209. Taken January 1960) and http://www.deadseascrolls.org.il/explore-the-archive/image/B-281083 (PAM M-42236. Taken January 1956); Milik, *BE*, 295–295; Drawnel, *Aramaic Astronomical Book*, 194–197, 384–385, 387–389.

4Q209 fragment 26, lines 2–3a b

2] in the sixth gate *in the h?*[
3a. twenty-five weeks and] two [d]ays. 3b. And it decreases[211] from the lead of the sun[[212]

The broken text, 4Q209 fragment 26, line 3a, refers to the chronological unit: "25 weeks and] two [d]ays" followed by a lacuna. Its similarity to *1 En.* 79:5a, is shown in Table 3.3.1 columns 1 and 2, below. This time-period is italicised:

TABLE 3.3.1 *The length of the lunar year in 4Q209 fragment 26, line 3a,b only compared*

4Q209 26 line 3	***1 En.* 79: 4–5**
3a. . . . *twenty-five weeks and*] *two* [*d*]*ays.* (3b). And it falls behind the path of the sun [[213]	4c) . . . accomplished in the first gate at its time (4d) until 177 days are completed, by the law of the week *twenty-five* (*weeks*) *and two days.*<?> (5a) It falls behind the sun

211 4Q209, frag 26, line 3b. מחסר, from the root חסר, "decrease," male, *pael* passive participle (Abegg, DSSEL), so VanderKam, *1 Enoch 2*, 517 n. 5; Albani, *Astronomie and Schöpfungsglaube*, 91; Milik, *BE*, 294; and דבר, "lead," masculine noun construct, with שמשא (Abegg, DSSEL); Black, *'Astronomical' Chapters*, 39; so Drawnel, *Aramaic Astronomical Book*, 197, 387, and also 408, rather than "course" ("from the course of the sun") in Tigchelaar and García Martínez, DJD 36, 164; VanderKam, *1 Enoch 2*, 517–519, argues that מחסר corresponds to the Ethiopic and that the Aramaic means "decrease" or "diminishment in a calendrical context," *1 Enoch 2*, 517, nn. 5,6.

212 Drawnel, *Aramaic Astronomical Book*, 197. cf. 4Q209 frag 26, line 3b: Milik, *BE*, 294, "And she falls behind the sun[. . .]"; Black, *'Astronomical' Chapters*, "And it (the moon) falls behind the course of the sun[. . .]" Tigchelaar and García Martínez, DJD 36, 164, "And it falls behind the course of the sun[. . .]"

213 For Drawnel's translation, restoration and comments on 4Q209 fragment 26, line 3a, see *Aramaic Astronomical Book*, see, 196–197, 384, 387–88.

214 Translation by Nickelsburg and VanderKam, *1 Enoch*, 110; VanderKam, *1 Enoch 2*, 515, 517–520; so Ben-Dov, "the law of the week," *Head of All Years*, 109. Also see, Neugebauer, *'Astronomical' Chapters*, 30, he translates, "or, after the reckoning with weeks, 25 (weeks) and two days."

Observing that the Ethiopic text is "related but different from" the Aramaic text, Tigchelaar and García Martínez stated, "One may assume that the Greek translator rephrased and rearranged the Aramaic text."[215] Similarly, Milik asked, "Do we have to assume that the Greek translator having—for obscure reasons—divided a single description of the original into two sections, likewise duplicated a single recapitulatory passage in two passages . . . ?"[216]

4Q209 fragment 26 line 2

2[ ]בתרעא שתיתיא בהֹ

2] in the sixth gate *in the h?*[

(My translation)

The parallel texts in the *Book of Luminaries* to 4Q209 fragment 26, line 2 ("in the sixth gate") that include gate numbers are *1 En.* 79:2–5 and *1 En.* 78:15–16. The translated extracts, including the reference to the "sixth gate," from the Aramaic Astronomical Book and to the "sixth gate" and "first gate" from the Ethiopic Astronomical Book which relate to 4Q209 frag. 26, line 2, are cited below:

1 En. 79:2–5

2. He showed me all their law for each day, each time in every jurisdiction, every year, its emergence, the command, every month, and every week;
3. the waning of the moon which is accomplished in the *sixth gate because in this sixth gate* its light is completed and from it comes the beginning of the waning
4. which is accomplished in the *first gate* at its time *until 177 days* are completed, by the law of the week *twenty-five* (*weeks*) *and two days*.
5. And how it falls behind the sun and the law of the stars five days exactly in one period and when this place which you see is traversed.[217]

215 Tigchelaar and García Martínez, "4Q209," DJD 36, 164.

216 Milik, *BE*, 294.

217 Nickelsburg and VanderKam, 110 adapted for other mss in notes; VanderKam, *1 Enoch 2*, 515.

Aside from the unusual time-length of half a lunar year expressed in weeks and days in both texts, the same 'gates' are referenced: the "sixth gate," is described for calendrical purposes in 4Q209 fragment 26, line 2 and cited in *1 En.* 79:3 (twice). The "first gate," which does not appear in 4Q209 fragment 26 is mentioned in *1 En.* 79:4 and in *1 En.* 78:15. The movement of the moon through the sixth and the first gates, respectively, is connected to the 354-day lunar year, or more precisely, the half-year.[218]

> 1 En. 78:15
>
> And for three months, at its proper time, it achieves thirty days, and for three months it achieves in each (month) twenty-nine days, during which it completes its waning, in the first (period of) time and in the *first gate*, in one hundred and seventy-seven days.[219]

Noting the overlap between the Ethiopic and Aramaic in *1 En.* 79:3–4 and 4Q209 frag 26, line 2, respectively, Vanderkam wonders why in the *Book of Luminaries* the "sixth gate would be singled out if the moon's monthly waning is under discussion, since the moon wanes in other gates, too." He states, "It is true, according to the chart related to the data in chap. 74, that at times the moon would wane in the sixth gate, but it wanes in the others as well."[220]

According to Laurence's translation of his late Ethiopic manuscript, in which he aligns the 'gates' to the zodiac signs, when the moon is full in Gate 6 in Cancer, the sun is in Gate 1, Capricorn, that is, around the winter solstice and the shortest day of the year. The year is presented in two halves, the shortest to the longest day: the sun moving from Gate 1, Capricorn, to Gate 6, Cancer, the longest day, and back again, Gate 6 to Gate 1.[221]

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218 Neugebauer, *'Astronomical' Chapters*, 30. Neugebauer stated that the numbering of the gates (the "sixth gate" and "first gate" in *1 En.* 78:15 and *1 En.* 79:3–4) referred to the order of the portals traversed by the sun in half a lunar year, and not to the ordinal gate numbers. He added that whole of chapter 79 was "only an expanded (and therefore more obscure) version of *1 En.* 78:15"; Charles, "Book of Enoch," 2:244 note to *1 En.* 78:15. He interpreted the sentences to mean that the author recognised two seasons in the year; Knibb, *The Ethiopic Book of Enoch*, 184–5. Knibb's translation of *1 En.* 78:15; 79:3–4 makes it plain that the verses are an abbreviation of the moon's journey.

219 Translation by Knibb, *Ethiopic Book of Enoch*, 184. Nickelsburg and VanderKam, *1 Enoch*, 109; VanderKam, *1 Enoch 2*, 500, 511–512.

220 VanderKam, *1 Enoch 2*, 517.

221 Laurence, *Enoch the Prophet* (1821), 205–206, continued in the discussion on 4Q209 frag 26, line 3a,b, below.

Drawnel argues that the Ethiopic text in Chapter 79 is an expansion as a result of redaction (without making any assumptions as to where in the copying process was made) and that the author of the Aramaic text was conveying the astronomical positions of the sun and moon when they were in Gates 1 and 6, according to the 'gate' system in Chapter 72.[222] His deduction is almost identical to that proposed by Laurence, but without the zodiac.

One key issue is whether the Greek or Ethiopic redactors worked out the arithmetic, exegeting the 25 weeks and two days into 177 days (7 days × 25 weeks +2 days) or whether "177" was original to 4Q209 fragment 26. The discourse on this partly centres on whether the Ethiopic text was received through the intermediary of Greek copyists and redactors, or directly from an Aramaic *Vorlage*.[223] The lunar time period of "177 days" in *1 En.* 79:4d also appears in *1 En.* 78:15d.

Both of these chronological lengths are measurements of half of a 354-day lunar year, consisting of three alternate 29-day and three 30-day months, expressed in two different forms: 6 months × 29.5 days (mean of 29 and 30 day months) = 177 days (= 354/2). It should be noted that the distinctive time-period of half a lunar year, "177 days," in *1 En.* 79:4d and *1 En.* 78:15d, also expressed as "25 weeks and two days" in *1 En.* 79:5a, which is part-extant in 4Q209 fragment 26, line 3a,[224] is unattested elsewhere in any of the other Dead Sea Scrolls:

4Q209 fragment 26, line 3a

שבעין חמש ועשרין וי] ומין תרין

twenty-five weeks and] two [d]ays.

222 Drawnel, *Aramaic Astronomical Book*, 387–388.

223 For example, Ben-Dov, *Head of All Years*, 109 n. 97 states that the time length, twenty-five weeks and two days in *1 En.* 79:4 is probably related to "typical Ethiopic methods of time-reckoning," citing: Neugebauer, *Ethiopic*, 226. However, the unusual calendrical period appears to be attested in 4Q209 frag 26, line 3a and therefore an original citation; cf. *Head of All Years*, 69–77. He rejects Knibb's arguments (Knibb, *Ethiopic Book of Enoch*, 37–46) that the Ethiopic translators worked to any extent at all from Aramaic versions, see *Head of All Years*, 70 n. 5, citing agreement with J.C. VanderKam, "The Textual Base for the Ethiopic Translation of 1 Enoch," in idem, *From Revelation. To Canon* (JSJSup 62; Leiden: Brill, 2000), 380–95. See also Knibb, *Ethiopic Book of Enoch*, 184 n. 78, 185; Drawnel, *Aramaic Astronomical Book*, 196, 384, 387, argues that "177 days" in *1 En.* 79:4d is original in the Aramaic.

224 Drawnel, *Aramaic Astronomical Book*, 196–197, 384, Drawnel notes that 4Q209 frag 26 partially concurs with Dillman's "intuition" that *1 En.* 79:3–5 originally preceded 1 En. 78:17 and most probably followed *1 En.* 78:16 (citing Dillman, *Das Buch Henoch*, 242).

Drawnel includes the phrase "177 days" in his reconstruction of 4Q209 fragment 26, lines 2–3a, arguing that it is original and not a gloss.[225] The possible appearance of the "weeks" (reconstructed) in 4Q209 fragment 26 line 3a, but not in the synchronistic calendar of 4Q208–4Q209, begs the question (if "weeks" existed) of whether the author of this text knew the 364-day Jubilees-Qumran calendar as point of reference. Vanderkam does not think that in *1 En.* 79:2 "week" (*sanbat*) is related to the 'weeks of years,' the seven-year unit in the *Book of Jubilees*, but the seven-day period, here in connection with the moon.[226] Since the "weeks" in the context of a lunar year are possibly known only from 4Q209 fragment 26 and are not conceptualised in the synchronistic calendar, there is the question of whether we should carefully separate the synchronistic calendar of 4Q208–4Q209 from 4Q209 fragment 26 and other sections that are not part of the synchronistic calendar.

4Q209 fragment 26, line 3b

ומחסר מן דבר שמשא[

. . . And it decreases from the lead of the sun [[227]

The second part of the sentence, 4Q209 fragment 26, line 3b, and the possible corresponding sentence in *1 En.* 79.5a—that the moon falls behind the sun by five days—means that in the *Book of Luminaries*, the solar year in the later parallel text is 364 days (*1 En.* 72:32b, *1 En.* 75:1–2, *1 En.* 5–6). This is because the moon's year is 354 days, therefore, in half a lunar year it falls behind the sun by five days and in one solar year the lunar calendar will have slipped by 10 days.[228] Does this mean, necessarily, that a 364-day solar year is indicated in the Aramaic astronomical fragments from the overlap of 4Q209 fragment 26, line 3b, which has an inter-textual connection with a possible 364-day year in *1 En.* 79:5?:

225 Drawnel, *Aramaic Astronomical Book*, 196–197; 387–389.

226 VanderKam, *1 Enoch 2*, 519, cf: Ben-Dov, *Head of All Years*, 109.

227 Translation discussed in previous subsection.

228 Neugebauer states that Chapter 79 is "is only an expanded (and therefore more obscure) version of *1 En.* 78:15" [see below], however, this section is closer to the extant Aramaic text that *1 En.* 78:15, idem, *'Astronomical' Chapters*, 30. Laurence states, "The lunar year being three hundred and fifty-four days, it is of course ten days shorter than the solar year (as computed in this book); so that its half year must consequently be five days shorter than the solar half year.", in *Enoch the Prophet*, 206 (comment to *1 En.* 78:4 in his manuscript, now renumbered to Chapter 79).

1 En. 79:5:

> [And how it falls behind the sun and the law of the stars five days exactly in one period and when this place which you see is traversed[229]

The number of days following the reference to the course of the sun in 4Q209 frag 26 line 3b, (see p. 329), is missing. It is clear that *1 En.* 79:5 describes a 364-day solar year, for if the 354-day lunar year falls behind the solar year (and the law of the stars, not extant in the Qumran text) by five days in 177 days, it will regress by 10 days in one solar year. Returning to the theme of intercalation, it is not disputed that *1 En.* 79.5 is interested in the half-year when the moon loses five days against the sun's 364-day year when the sun completes its journey between Gate 1 and Gate 6. The Ethiopic text is apparently advocating intercalating five days every 177 days which is the same as 25 weeks and two days when the moon is in Gate 1 and Gate 6, or during the moon's passage between those portals.

177 days + 5 days in Gate 1 and + 5 days in Gate 6 = 177 + 177 + 10) = 364 days

The text connects intercalation, a method to keep the moon and the stars in step with the solar calendar, with the 'gate' position of the moon and sun at the solstices. Crucially, the information following the course of the sun in 4Q209 fragment 26, line 3b is broken;[230] therefore, whether the formula for intercalating a 354-day calendar (adding five days per half a year) exists in the Aramaic sentence, or is a gloss in the Ethiopic recension, is uncertain.[231] Drawnel does, however, take it for granted that the break in the Aramaic text can be reconstructed to completely coincide with the Ethiopic data.[232]

Neugebauer translates and interprets the Ethiopic text for both passages as referring to the moon's "recession" and "decrement," meaning the moon falling behind the sun in the calendar, and not its waning.[233] Laurence's

229 Nickelsburg and VanderKam, 110, adapted for other mss, note *y*. VanderKam, *1 Enoch* 2, 517–520.

230 See García Martínez and Tigchelaar, DJD 36, pl. 7; Drawnel, *Aramaic Astronomical Book*, Pl. 6, or best, online as cited above (for link to 4Q209, frag 26, see p. 324 n. 210), line 3.

231 Drawnel, *Aramaic Astronomical Book*, 196–197, 387–390. Drawnel agrees that the text is referring to the difference of five days per half year between the sun and the moon, as does VanderKam (note above), however, he suggests that the description is connected with the surface of the moon as the next verses are associated with the "Man in the moon."

232 Drawnel, *Aramaic Astronomical Book*, 389.

233 Neugebauer, *'Astronomical' Chapters*, note to *1 En.* 79:3–4 and *1 En.* 78:15–16, 30.

translation reflects his later manuscript. It loses "the lead"[234] from the sun and he translates his Ethiopic text to refer to the moon falling behind the sun in the calendar, not its waning, although he interprets the text in those terms in his Remarks to *1 En.* 78:3 (now *1 En.* 79:3).

Not examined here because it is not calendrical *per se*, is the subsequent Aramaic "man in the moon" passage: 4Q209 fragment 26, lines 4–8 (overlapping with *1 En.* 78:17), the remainder of the fragment. It is, however, relevant for the possible meaning of 4Q209 fragment 26, line 3b—the moon's waning, or the decrement in the lunar calendar. This pericope describes pictorially the receding of the moon's light. Its immediate presence could suggest that the interpretation of "and the decrease from the lead of the sun" is connected to the waning of the moon's light after full moon, as the text may be interpreted as referring to the shadows on the waning moon's surface in terms of anthropomorphic visual imagery: the likeness of a man.[235]

The "man in the moon" text, 4Q209 fragment 26, lines 4–8 as well as being literary contains direct speech, in which Enoch may be addressing his son Methuselah (see note above) as "my son," ברי (4Q209 frag 26 line 4 = 1 En. 79 1). As such, it implies that 4Q209 fragment 26, lines 2–3 may be part a spoken monologue imparting wisdom. So the two lines on the "sixth gate" and the twenty-five weeks and two day time period may be part of the "my son" speech, rather than related to a non-verbally-based mathematical section, like the synchronistic calendar of 4Q208–4Q209. Therefore, 4Q209 fragment 26, lines 2–3

234 Drawnel notes that the later Ethiopic manuscripts do not have the Ethiopic term for "lead," דבר, *Aramaic Astronomical Book*, 385. So Laurence, *1 En* 78:3 (now ch. 79) in *Enoch the Prophet* (1821), 205: "Its decrease is effected in the sixth gate in its period, until a hundred and seventy-seven days are completed."

235 Milik, *BE*, 296; Knibb, *Ethiopic Book of Enoch*, 184; Black, "Additional Notes on the Aramaic Fragments," in Neugebauer, *'Astronomical' Chapters*, 38; Nickelsburg and VanderKam, *1 Enoch*, 109; VanderKam, *1 Enoch 2*, 500–502, 511–520; Tigchelaar and García Martínez, DJD 36, 163–164; Drawnel, *Aramaic Astronomical Book*, 194–197, 383–393.

The text is also important for the ordering of the overlapping Ethiopic material {*1 En.* 78:17–79:1}. This is version contains verbatim instruction possibly to Methuselah in later Ethiopic manuscripts, addressed as "my son" apparently by Enoch who is transmitting teachings from Uriel: Nickelsburg and VanderKam, *1 Enoch*, tran*slation, 1 En. 79*:1, 6, *p. 110 note w; VanderKam, 1 Enoch 2,* 515, note to *1 En.* 79: 1a. Methuselah is also addressed in *1 En.* 76:14, and in *1 En.* 82:1. None of these names, Uriel, Enoch or Methuselah, is in the Aramaic astronomical text). For the convention of parents addressing offspring, and teachers speaking to pupils as "my son" in ancient Near East wisdom literature, see B. Colless, "Divine Education," *Numen* 17 (1970): 22, and the link between wisdom, divination and astrology in ANE literature, ibid., p. 29.

appears to belong to a different format, if not a genre, to the formulaic calendar of 4Q208–4Q209.

On material grounds, the astronomical formula of 4Q209 fragment 26, lines 2–3, is too fragmentary for us to be able to judge whether there was blank space after the text. The guideline space between 4Q209 fragment 26, lines 3–4, the end of the factual formula and the first line of the literary pericope, is slightly thinner than the 2 cm gap between 4Q209 fragment 26, lines 2–3. Given their proximity, the passages in 4Q209 fragment 26, lines 2–3, and 4–8 could be considered as related units of text, although since the former is factual and the latter uses literary language, their styles are also significantly different.

VanderKam in his translation and commentary to *1 En.* 79:3–5 makes similar points to Neugebauer, that the lunar "decrease" in the Ethiopic probably refers to the moon's loss of five days against the solar half-year, and not to the moon's waning, "In the time it takes for the sun to travel through six gates, the moon drops five days behind it."[236]

Laurence's zodiacal paradigm in the *Book of Luminaries* explains his understanding of the verse in his translation.[237] When the full moon is in Cancer "the turning point of the sixth gate" it is in the northernmost gate. The period in question will be during the time of shortest day of year [or longest night] when the sun is in Gate 1, Capricorn, the opposite sign to Cancer. The sun is opposite the moon at full moon and, therefore, Gate 6 (Cancer) is the place where the moon begins to wane in the "sixth gate." It "falls short" of the sun's half-year by five days when the sun travels between Gate 1 and Gate 6. The moon takes 25 weeks and two days to make the same journey.[238]

As the scanty remains of 4Q209 fragment 26, lines 2–3a are closely related to *1 En.* 79:3–5 in the Ethiopic *Book of Luminaries* but incomplete and belong to a separate unit of text to the synchronistic calendar, both spatially—on different fragments—and in terms of textual content, we cannot conclude that the solar year in the synchronistic calendar of 4Q208–4Q209 is 364 days as seems to be the case in *1 En.* 79:3–5. Before moving further on to the issue of the solar year in the synchronistic calendar of 4Q208–4Q209 there is a note below on the alternating 29 and 30 months, an apparent feature of the lunar year in 4Q208–4Q209, based on the manuscript evidence of 4Q209 fragment 6, line 9, and the, "25 weeks and] two [d]ays" in 4Q209 fragment 26, line 3a, as discussed.

236 VanderKam, *1 Enoch 2*, 518.

237 Laurence, *Enoch the Prophet* (1821), see 198–199, 201, 205–206.

238 Laurence, *Enoch the Prophet* (1821), 205.

Alternating 29 and 30 months

An arrangement of 29 and 30-day alternating lunar months is known from the Hebrew calendars of the priestly courses at Qumran, the *mišmarot*, 4Q320, 4Q321, 4Q321, in which 29 and 30 day schematic lunar months are synchronised with the 364-day Jubilees-Qumran calendar (not a solar calendar) in six year cycles.[239] The Hebrew Cryptic A calendar, *4QcrypticA Lunisolar calendar* (4Q317) probably has alternating 29 and 30 days months because a 29-day schematic lunar month has been reconstructed from the largest, joined fragment).[240]

The first century B.C.E. writer Geminos stated that the Greek civil calendar worked with 59-day double lunar months consisting of consecutive pairs of 29 and 30-day months.[241] While there is an extensive scholarly discussion on the actual practice of this system, particularly from Pritchett and Neugebauer, Meritt, Dunn, Hannah, Stern[242] it would appear that the scheme of alternating schematic 29 and 30-day months was known in Greek society, even if the statement proved to be theoretical rather than describing an actual calendar, or was subject to political tampering. Stern has pointed out that schemes of alternate 29 and 30-day months are attested in as far back as the 19th century B.C.E. in Egypt,[243] though more relevant to this study is the early second century B.C.E. Ptolemaic P.Rylands 589 (formerly Inv. 666), discussed in Chapter 5, which, Stern observes, contained the pattern of alternating 29 and 30-day

239 See the "D" (dwq) and "X" marks in Talmon et al., DJD 21, Table 1, 16–28, see *4QCalendrical Document/Mishmarot A* (4Q320) fragment 1, column i, lines 1–14, column ii, lines 1–14, fragment 2, 9–14, DJD 21, 43–50.

240 M. Abegg, "Various Calendrical Texts: 4Q317 (4QcryptA Lunisolar Calendar)," DSSR 4, 58–72; Jacobus, "A Study of 4Q317," 79–84.

241 J. Evans and J. Lennart Berggren, *Geminos's Introduction to the Phenomena: A Translation and Study of a Hellenistic Survey of Astronomy* (Princeton: Princeton University Press, 2006), Chapter VIII.3, 176, n. 3.

242 Pritchett and Neugebauer, *Calendars of Athens*, 1–14. For a summary of the discussion on the 29/ 30 day schematic months in the civil Greek calendar in the context of the calendars of Qumran priestly courses, see Jacobus, "The Babylonian Lunar Three: A Response" 45–49. On the question of alternating schematic full and hollow months, see W. Kendrick Pritchett, "Calendars of Athens again," *Bulletin de correspondence hellénique* 81 (1957): 269–301; B.L. van der Waerden, "Greek Astronomical Calendars and their Relation to the Athenian Civil Calendar," *The Journal of Hellenic Studies* 80 (1960): 168–80; B.D. Meritt, "The Hollow Month at Athens," *Mnemosyne* 30 (1977): 217–242; F. Dunn, Tampering with the Calendar," 213–23; R. Hannah, *Greek and Roman Calendars: Construction of Time in the Classical World* (London: Duckworth, 2005), 29–55, Stern, *Calendars in Antiquity*, 38–49.

243 Stern, *Calendars in Antiquity*, 145–6.

months[244] (based on Turner and Neugebauer's material reconstruction, which they stated, however, was not conclusive).[245]

This 29/30 alternate month arrangement is not explicitly part of the system of *4QZodiac Calendar* which works with an ideal year of 360 days and the moon, and can be traced to Mesopotamia. There are no weeks, or a 354-day calendar in 4Q318. The observation to be made at this juncture, then, is that the schematic alternating 29 and 30 day month pattern in the 354-day lunar year appears to be attested in the synchronistic calendar 4Q208–4Q209 and 4Q209 fragment 26. It is probably known in 4Q317, in contemporaneous Greek science, and some Ptolemaic calendrical texts. The issue of the length of the solar year in 4Q208–4Q209 is examined next.

3.3.2 *Is There a 364-Day or a 360-Day Solar Year in the Aramaic Fragments?*

Although an apparent reference to the lunar year of 354 days appears to have been preserved in both the Aramaic and Ethiopic recensions, the question of the length of the solar year in 4Q208–4Q209 is completely unknown in the Aramaic manuscripts due to their fragmentary state. This sub-section studies the inter-textual aspects of the literary passages that concern the solar year-length in 4Q209 and in the Ethiopic Astronomical Book and where they may conceivably overlap, in order to investigate the length of the solar year in the synchronistic calendar of 4Q208–4Q209.

Moving onto yet another fragment in search of the solar year in the Aramaic Astronomical Book, the 360-day year is attested in the Ethiopic pericope *1 En.* 82: 9–13,[246] a section that has an inter-textual relationship with 4Q209 fragment 28, lines 1–5 but which is, again, broken in the places in the Aramaic manuscript where the calendrical information is crucial:

1 En. 82:9–13[247]

> 9. [variant: a year is completed in 364 days] This is the name of the law of the stars which set in their places, at **their times, on their festivals, and in their months**.

244 Stern, *Calendars in Antiquity*, 152.

245 E.G. Turner and O. Neugebauer, "Gymnasium Debts and New Moons," *Bulletin of the John Rylands University Library* 32 (1949): 87.

246 Nickelsburg and VanderKam, *1 Enoch*, 114–5; Neugebauer, *'Astronomical' Chapters*, 31–33; Black: "Aramaic Fragments," 39; Knibb, *Ethiopic Book of Enoch*, 188–90; Ben-Dov, *Head of All Years*, 22–24.

247 Translation: Nickelsburg and VanderKam, *1 Enoch*, 114; see also, VanderKam, *1 Enoch 2*: 557–562.

10. These are the names of those who lead them, who keep watch so they enter at their times, [who lead them in their places], in **their orders, in their times, in their months, in their jurisdictions, and in their positions**.
11. **Their four leaders** who divide the four parts of the year enter first, and after them (come) the twelve leaders of the orders who divide the months, and [some mss. add: the year(s) into 364 days with] and the 360 heads of thousands **who separate the days**, and the four additional ones with them are the leaders who separate its four parts [the four parts of the years].
12. (As for) these heads of thousands between the leader and the led, one is added behind the position and their leaders make a division.
13. **These are the names of the leaders** . . .

4Q209 fragment 28, lines 1–5[248] cf. 1 En. 82:9–13

9 cf. 1 מעדיהון לחדשיהון לדגליהון וֹ[
10 cf. 2 וכש]לטֹנהון לכל מסרתהון אר[בעת
11 cf. 3]ן ראשין ד[י]לֹ[
12 cf. 4 מפ]רשין בי[ומין
13 cf. 5 וא]לֹ ן שמהת[

4Q209 28 1–5

1. with regard to] **their appointed times,**[249] **to their new moons/ months, to their signs. And** [
2. and **according to] their [d]ominion to all their stations. Fo[ur**
3. **] [?] heads of [**
4. **di]viding the d[ays**
5. and th]**ese are the names of** [

248 Nickelsburg and VanderKam, *1 Enoch*, 114–115, note. *z*; Tigchelaar and García Martínez, DJD 36, 165–166 (pl. 7). Dead Sea Scrolls digital library online: http://www.deadseascrolls.org.il/explore-the-archive/image/B-284657 (Plate B-284657; PAM: M-43209) (Photograph taken in 1960). My translation.

249 There seems to be blank space before מעדיהון "their appointed times"; Tigchelaar and García Martínez, DJD 36, 165–166 accept the alternative interpretation of "their periods" in line with Milik's suggestion that מועדיהן pertains to "their zodiacal periods" (Milik, *BE*, 187); see also, Drawnel, *Aramaic Astronomical Book*, 198–200, 393–409.

(The possible inter-textual connections have been highlighted in bold and underlined.) All of 4Q209 frag 28, lines 1–5 is contained in a different arrangement in *1 En.* 82: 9–13. The figure 360 in the Ethiopic is not attested in the Aramaic text and "Fo[ur" in 4Q209 fragment 28, line 2 has been reconstructed as אר̊[בעת from the initial letter *aleph*, the sole visible character at the edge of the fragment from the word.[250] Tigchelaar and García Martínez did not reconstruct the unknown, word before ראשין in line 3, which also has just one surviving letter, a final *nun*.[251] Drawnel restored this number as [ד[י]ן ראשין תלת מאה ושתי]ן. . . .three hundred and sixt]y heads o[f] [according to different Ethiopic manuscripts used by Milik for his suggested restoration.[252]

A case for the length of the solar year as 360 days is that the Aramaic Astronomical Book appears to be aware of the measurement of 360 in 4Q211 column ii, lines 2–6 and 4Q211 column iii, lines 4–10, in an array of fractions.[253] These columns do not exist in the Ethiopic Astronomical Book and they follow 4Q211 column i, lines 2–6.[254] This has a thematic and loose correspondence with *1 En.* 82:16–17 and *1 En.* 82:19–20, a detailed section on the seasons that appears to be inserted into a long passage about leaders of the stars in relation to the calendar, *1 En.* 82: 9–20. Milik suggested that the role of the angel Kôkab'el כוכבאל, *Star of God*, is referenced in this section.[255] Albani proposes that the pericope may be connected with 4Q277, a literary fragment describing Enoch's lessons from the angels on the courses of the stars and calendar:[256]

250 Tigchelaar and García Martínez, DJD 36, pl. 5.

251 Tigchelaar and García Martínez, DJD 36, 166.

252 Drawnel, *Aramaic Astronomical Book*, 198–200, contra Milik, *BE*, 295–6, who restored the number "without doubt," based on his Ethiopic manuscript to "and for three hundred and sixty-four days there are] chiefs of thousands" ולתלת מאה ושתין וארבעת יומי]ן ראשין ד [א]לפ[ין.

253 Milik, *BE*, 296–297, pl. 29; Nickelsburg and VanderKam, *1 Enoch*, 115–116; Neugebauer, *Ethiopic*, 169; Albani, *Schöpfungsglaube and Astronomie*, 60–67; Drawnel, *Aramaic Astronomical Book*, 232–234, 413–419.

254 See also Black, "Aramaic fragments," 39–40; Milik, *BE*, 296–297, pl. 29; VanderKam, *1 Enoch 2*, 566–567; Drawnel, *Aramaic Astronomical Book*, 231–232.

255 Milik, *BE*, 20; Kokabel, the fourth angel in *1 En.* 6:7: 4Q204 1ii 25, 4Q201 1 iii 7 and *1 En.* 8:3.

256 Albani, *Astronomie und Schöpfungsglaube*, 63, 65; Milik, *BE*, 12; J.C. VanderKam and J.T. Milik, "4Q227. 4QpsJub^{c}?" *Qumran Cave 4: 8. Parabiblical Texts. Part 1* (DJD 13; Oxford: Clarendon, 1995), 171–175, pl. 12. (See 4Q227 discussed on pp. 236–240 on the calendar).

4Q211 (*4QEnastr*[d]) fragment 1, column ii, and frag 2 col. i lines 1–6[257]

2 דן מן [258]משחתה °[
3 מעשר תשיע ח[ד
4 תשיע חד וכוכ[בין] [259]נזחו בְּ[תרעי] שמיאֹ קד[מיא ובאדין] נְפֹקו
5 ביומא קדמיא [חד] מעשׂ[ר בשתי]ת חד ותניניא חד מן חמשת
6 עשר בשתית חֹ[ד ו]תלתיא ח[ד מ] ן תלתין בשתית חד *vacat*

4Q211 (*4QEnastr*[d]) fragment 1, column ii, and frag 2, col i, lines 1–6

2. [...] this [...] from its measure [...]
3. a tenth (part) of o[ne] ninth
4. one ninth. And the sta[rs] move through the fir[st] [gates] of the heavens;[and then] they go out.
5. On the first days, [one] tenth by one si[xth]; on second (days), from one fifth-
6. teenth by o[ne]-sixth, [and on] the third (day) one from thirty by one-sixth

4Q211 fragment 1, column ii lines 4–6[260]

4 בְּ[יום חמ] שׁתֹ עֹ[שר] °[ ] ובאותה בימֹ[מא
5 אדֹ [ב] לֵילֵיא דן מן לֹ[. . ת] לת תשיע וֹחֹמשׁ[ת
6 ומעשר תשיע *vacat*

257 *4QEnastr*[d]*-4Q211*. Plate 369. Frag 1. (cols. i and ii) B-361388. Online: http://www.deadseascrolls.org.il/explore-the-archive/image/B-361388

Col ii in fragment 1 continues in Fragment 2, col i, *4QEnastr*[d]*-4Q211*. Plate 369. Frag 2. (cols. i and ii) B-361390 http://www.deadseascrolls.org.il/explore-the-archive/image/B-361390

Reconstruction of lacunae, Milik, *BE*, 296 (pl. 29; the column numbering is confusing and there are no frag. numbers); translation: Milik, *BE*, 297, Nickelsburg and VanderKam, *1 Enoch*, 116, modified by this author; see also, Drawnel, *Aramaic Astronomical Book*, 232–233, 413–418 (pl. 8; fragment numbering is confusing, frag 2 is listed as frag 1; the transcription is the same as Milik's). This and the next column have no parallel in the *Book of Luminaries*.

258 Line 1. Feminine singular construct of משחה, Abegg, DSSEL, translation, Milik, *BE*, 297.

259 Line 4. Translation Milik, *BE*, 97. Abegg, DSSEL, *peal*, third person male plural of נזח.

260 Lacunae reconstructed by Milik, *BE*, 296. Fragment 2, col i, *4QEnastr*[d]*-4Q211*. Plate 369. Frag 2. (cols. i and ii) B-361390 http://www.deadseascrolls.org.il/explore-the-archive/image/B-361390

4Q211 frag 2 col. ii lines 4-6

4. On the fif]teen[th (day) [...] and in the (same)[261] day [...]
5. only [in this] night from [...] a third of a ninth and fi[ve ...] (or fifteen)[262]
6. and a tenth of a ninth [...]

The unit fractions in this fragment are fascinating: they are not divisible by seven, like the parts of the moon's waxing and waning in 4Q208–4Q209 and they are not expressed sexagesimally, as in Babylonian mathematics (a third of a ninth {1/27th} mitigates against this). However, the numbers in 4Q211 frag 2, column ii are all in denominations of 360. Here, the unit fractions are composed with denominators in ninths (40th parts of 360) and sixths (60th parts of 360) arranged in smaller divisions that descend in size proportionately. They are combined on days 1, 2, and 3 with numerators that ascend in size in a pattern of five doubled: 10, 15, 30. The fractions may be rephrased as follows:

4Q211 fragment 2, column i, lines 5–6

Line 5a: 1/60th on day 1 = a tenth of one-sixth of 360.
Line 5b–6a: 1/90th on day 2 = a fifteenth of one-sixth of 360.
Line 6c: 1/180th on day 3 = a thirtieth of one-sixth of 360.
The text may then be read mathematically:

4Q211 fragment 2, column i, lines 2–6

Line 3: One tenth of one-ninth =1/10 × 1/9 = 1/90th
Line 4b: One ninth part = 1/9th and the stars move through the first gate (Sagittarius/Capricorn) and then go out

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Black and white (clearer) Plate 369. Frag 2. (cols. i and ii) B-361391 http://www.deadseascrolls.org.il/explore-the-archive/image/B-361391. (Listed as 4Q211 fragment 1, col. iii, in publications before renumbering in digitisation).

261 Line 4. So Milik, *BE*, 297, and Abegg, DSSEL, understanding ובאותה as an object marker with a third person, male, singular suffix; Drawnel translates ובאותה as "in its sign," *Aramaic Astronomical Book*, 233–234.

262 Line 5. It is uncertain whether there should be עשר after ת]וחמש (for fifteen); I have left this suggestion open. See also, Drawnel, *Aramaic Astronomical Book*, 233–234; 418–419; he suggests: "fiv[e of a ninth" ת תשיע]וחֲמֵשׁ to stay wth the pattern becoming progressing smaller in increments.

So, on the first day: one tenth by one sixth = 1/10 × 1/6= 1/60th
On the second day: one fifteenth by one sixth = 1/15 × 1/6= 1/90th
On the third day: one thirty by one sixth= 1/30 × 1/6 = 1/180th

Milik suggests that the figures refer to degrees in the circle, and the lowest common denominator of 360 refers to the number of degrees on the celestial sphere in relation to the daily movement of the stars. Thus, if the fractions refer to degrees:

On the day 1 the stars move 60/ 360 = 6°
On the day 2 the stars move 90/ 360 = 4°
On the day 3 the stars move 180/ 360 = 2°[263]

Milik's proposal, borrowing the concept of the 360° celestial sphere from astrology seems logical. Neugebauer dismisses Milik's hypothesis as not making sense,[264] but he does not discuss the astrological interpretation. Instead, he proposes that the fractions are connected with the 18-division of the nychthemeron (the number of total hours of daylight and night lengths) found in Ethiopic texts.[265] It may be countered that Milik's astrologically-related suggestion is more in keeping with the context of the Aramaic material in relation to the section on the named leaders of the stars in the *Book of Luminaries*, as discussed above, as well as 4Q211 frag 1 col. ii, and frag. 2 col. i, line 4b. Drawnel argues that, mathematically, Neugebauer's solution does not fit in mathematically with the Aramaic text.[266]

In 4Q211 fragment 2, column ii (below) on the evening of the full moon, the fifteenth day, there is an ambiguous unit fraction in line 5c. Milik regards the number five (or fifteen) as a separate number in his translation;[267] Nickelsburg and VanderKam treat it as part of a compound fraction consisting of a whole number with one third of a ninth in line 5b:[268]

263 Milik, *BE*, 297.
264 Neugebauer, *Ethiopic Astronomy*, 169, n. 8.
265 Neugebauer, *Ethiopic Astronomy*, 169, 167–169.
266 Drawnel, *Aramaic Astronomical Book*, 415–416.
267 Milik, *BE*, 297.
268 Nickelsburg and VanderKam, *1 Enoch*, 116.

4Q211 fragment 2, col ii lines 4–6

4. On the fifteenth day: . . . on the same day [full moon]
5. But in this night . . . one third of a ninth and fi[ve [or fifteen] = 1/3 × 1/9 + 5
6. And a tenth of a ninth = 1/10 × 1/9 = 1/90th

Milik's interpretation of the fractions, treating "one third of a ninth" and "and fi[ve" separately would produce:

1/3 × 1/9 = 1/27. Plus the broken 5 number[269]

Drawnel observes that 4Q211 frag 2 column ii, line 6, (which he numbers frag 1, col. iii) "and a tenth of a ninth" followed by a final *vacat* means that the 15th day ends here and that the section is "dedicated to the first fifteen days of a month that began in 4Q211 fragment 1 column ii, line 5," thus, probably a 30-day month.[270] Following Milik's suggestion, my main point is that the unit fractions in 4Q211 fragment 2 columns i and ii assume knowledge of 360 degrees and the daily movements of the stars. Therefore, the 360 degree circle was known by the author of 4Q211. By extension, 360 degrees is connected to the zodiac calendar of twelve 30-day months.

3.4 Summary and Conclusion

This chapter reconsidered Neugebauer's assertion that there is no relationship between the heavenly 'gates' in the Ethiopic *Book of Luminaries* and the movements of the sun and moon through the signs in the zodiac. It argues that he did not properly evaluate the transmission history of this scheme, dismissing its reception in fourteenth century Ethiopic lunar tables that he claimed used zodiacal Islamic astronomy, and again, repudiating the zodiacal interpretation by Richard Laurence which he wrongly attributed to R.H. Charles, who did not explain the full thesis. Furthermore, Neugebauer died before 4Q318 was published and so he could not evaluate the comparative astronomical Aramaic text from Qumran. In any court of appeal one would say that the evidence was never properly evaluated and subsequently new evidence has come to light. Nonetheless, Neugebauer's declaration has been applied by modern scholars

269 So interpreted by Ben-Dov, *Head of All Years*, 194; he does not discuss the broken "and fi[ve" number; so also Drawnel, *Aramaic Astronomical Book*, Table 3.30, pp. 416, 419.

270 Drawnel, *Aramaic Astronomical Book*, 419.

to the Aramaic fragments with the result that the Aramaic Astronomical Book has not been recognised as a zodiac calendar.

While not disputing Neugebauer's explanation that the numbers of the 'gates' can represent the sun's rising and setting points on the horizon throughout the year (though he thought the 'gates' were numbered in sequence, not as ordinals) I have put forward the argument that the same 'gates' also represent the moon's passage through the zodiac signs. The sun rises and sets in same fixed position on the horizon for about a month as evidenced by the Graeco-Roman sundials discussed in the next chapter. One cannot infer the sun's zodiac sign because the stars cannot be seen during the day; the zones on the horizon where the sun rises and sets correspond with this information. The moon's position in the zodiac can be more accurately seen at night against the stars rather than from its rising and setting points on the local horizon which varies daily according to its phase and celestial latitude. During the day in its waning period, its position against the stars cannot be seen but the zodiac sign can be reckoned from its phase and the date in the calendar. As shown in Chapter 1, it is still possible to gauge the moon's zodiac sign from the date in the Hebrew calendar, which is also indicated by the moon's phase.

The theory was advanced that the sun's month begins and ends at the entry to the zodiac signs and that these corresponded to the sun's rising in the 'gates.' By correlating the solar zodiac signs to the 'gates,' I argued that 4Q209 fragment 7, column iii, lines 1–2 described the sun's entry into Capricorn in Gate 1, at the winter solstice when the moon was in its waxing phase in Aries on the 8th day of the 10th lunar month in Gate 4. Milik referred to the moon's day in this text as "the 8th Tebeth," with which the zodiac paradigm agreed. It was also noted that the 8th Tevet falls on the winter solstice in the 19-year cycle (the 'Metonic' cycle) in the Babylonian Uruk scheme in the Babylonian horoscopes presented in Chapter 1. One may suggest, therefore, that the synchronistic calendar of 4Q208–4Q209 is also interested in when the solstices align with the lunar calendar and that it follows a similar luni-solar cycle to the Babylonian calendar.

I have reservations about Drawnel's pioneering hypothesis that the lunar fractions of half-sevenths in the text referred to time intervals connected to when the moon rises and sets, in relation to the sunrise and sunset. My reservations are that, as I agree with Milik that a synchronistic calendar exists in 4Q208–4Q209, the visible changing phases of the moon seen as increasing and decreasing recognisable portions of light on the moon's surface seem to be easier to use to reckon the date in the calendar. The mathematical zig-zag function (Day 1 = 0.5/7ths, lunar crescent, progressing until Day 14 or 15 = 7/7ths, full moon, although this fraction is never used), also describes the changing shape of the lunar disk throughout the month, and therefore, represents an instantly visible incremental count of the moon's orbit of the earth. A similar scheme

appears in other related calendars at Qumran such as 4Q317 which has similar lunar fractions of fourteenths (and 4Q503, although the calendrical pattern is more difficult to interpret and reconstruct), but Drawnel does not comment on these. Furthermore, 4Q209 frag 26 lines 4–5 (similar to *1 En.* 78 17b) describes a "likeness of a man," indicating that the physical experience of the moon's surface plays a part in the calculations of the calendar.

Points in favour of Drawnel's hypothesis are that it is linked to the schematic lunar pattern in the ancient Near Eastern text, *EAE* 14, and Mesopotamian science, and he lays the foundation of an interesting, astronomically intricate philological hypothesis. However, I have rejected his position that 4Q208–4Q209 was not a form of a synchronistic calendar on the grounds that he does not take into account the 'gates' and the sun into his theoretical construction. A hypothesis needs to be able to explain all the elements in a text. The 'gates' and the sun are part of the 4Q208–4Q209 scheme and their roles, ingeniously integrated into a calendar by Milik, cannot just be ignored. By failing to account for these important features, and rejecting the synchronistic calendar and the zodiac, Drawnel's hypothesis, as it stands, is incomplete.

It is here suggested that the synchronistic calendar of 4Q208–4Q209 is probably related to a 360 day solar calendar synchronised with a 354-day lunar calendar [interestingly, see *1 En.* 74:10a, 11, p. 274] and harmonised with the signs of the zodiac, the 'gates'. The sun moves into the next zodiac sign monthly and the moon changes sign every two to three days. The text highlights the turning points of the year, the *tequfot*, the solstices and equinoxes. These are defined by the sun and not the luni-solar month date, which shifts. So the luni-solar date in our text, 8/ Month X (equivalent to Tevet) coincided with the winter solstice, a marking point in the Uruk scheme, and an alignment in the 19-year cycle recorded in a third century B.C.E. Babylonian horoscope text.[271] In 4Q209 fragment 7, the position of the sun appears at the top of a new column, 4Q209 frag 7, col. iii, lines 1–2 in Gate 1. I argued that the beginning of a new astronomical unit of text at the top of a column was significant.

In *4QZodiac Calendar*, it is interesting to note that the copyist of 4Q318 had apparently indicated calendrical time by starting Tishri, the second half of the year, after a blank line (4Q318 col. iv, line 9); the full moon of Tevet at the beginning of a new column (4Q318 col. vii, line 1); and the beginning of the twelfth month, Adar, at the beginning of a new column (4Q318 column viii, line 1). It is likely that important sections of the calendar were placed prominently. I suggest that the scribes of these calendars, 4Q208 and 4Q209 and 4Q318, as we have already seen, wrote their calendar texts in a meaningful visual arrangement.

271 See p. 310 n. 179.

The use of the 'gate' numbers to correspond with the zodiac signs may be traced to cuneiform numerical substitution which flourished in Mesopotamia, as discussed in Chapter 1. There is no reason to suppose that the zodiac signs were deliberately suppressed in the Ethiopic Astronomical Book because they have "heathen," Babylonian origins, or that they were deliberately avoided, yet known, by the authors of the Qumran Astronomical Book.

Although the calendar systems in *4QZodiac Calendar* and the Aramaic Astronomical Book may be related as zodiacal constructs, there are similarities and differences. In practical terms, the Qumran Astronomical Book is more detailed than 4Q318 with reference to when the moon may be observed in a 'gate': it contains explicit lunar phases in addition to giving the day of the lunar month. I suggested as Albani had done, that there was no reason to reject the harmonising principle of Milik's synchronistic calendar, but the theory need not necessarily include a triennial cycle, as Milik had proposed.

It was not possible to state conclusively whether the texts of 4Q208 and 4Q209 described the same years, although it appeared that 4Q209 column ii and column iii agreed with the Babylonian 'Dodekatemoria scheme,' examined in Chapter 1. However, the amount of material containing 'gate' numbers did not extend for seven or eight consecutive nights, the time period needed to make more precise comparisons. The significance of the probability that the author of *4QEnastr^{d}* (4Q211) knew of the 360 degree circle supports the hypothesis that *4QZodiac Calendar*, which has 360 days, and the Qumran Astronomical Book probably emanated from related traditions.

In terms of comparative texts outside of Qumran, the alternating 29 and 30 day (hollow and full) months in 4Q208–4Q209 can be traced to Greek calendrical science. Although 4Q318, it is argued, is a borrowed late Babylonian scheme, it uses zodiac signs *per se* rather than Babylonian number substitution as, it is now proposed, exists in the Aramaic Astronomical Book.*

* The article by Dennis Duke and Matthew Goff, "The Astronomy of the Qumran Fragments of 4Q208 and 4Q209," *Dead Sea Discoveries* 21 (2014): 176–210, was published too late for inclusion. In relation to their p. 204, I should add that while it cannot be ruled out that 4Q209 frag 28 may refer to a 364 day year, the synchronistic calendar of 4Q208–4Q209 does not mention Sabbaths or weeks, and it is therefore, unlikely that this calendar is sabbatical, that is, having 364 days by the addition of an extra day at the end of each three-month season.

CHAPTER 4

The 'Enoch Zodiac' and Greco-Roman Zodiac Sundials

> . . . the revolution of the heavenly bodies is evident on many grounds, but it is particularly evident from the phenomena of the sun-dial.[1]

4.1 Introduction

The purpose of this chapter is to argue that the system of the 'gates' in the Aramaic Astronomical Book preserved at Qumran was part of widespread applied scientific knowledge in the Greek and Roman world. In particular, evidence will be presented from archaeology and texts from the ancient Mediterranean world that the arrangement of the sun's 'gates' in *1 En.* 72:2–34, appears in a substantial number of Greco-Roman zodiacal sundials as a cosmological paradigm, rather than as simply the listing of zodiac signs in an anticlockwise direction. The case for the alignment between the 'gates' and zodiac signs was put forward in the previous chapter where it was argued that the gate numbers in *1 En.* 72:2–34 represent zodiac signs in *4QAstronomical Enoch*$^{a-d}$ (4Q208–4Q211). The specific geometrical arrangement of the solar zodiac signs as correlated with the heavenly gates of *1 En.* 72 will be referred to henceforth as the 'Enoch Zodiac.'

The term 'Enoch Zodiac' is purely descriptive and does not imply that 4Q208 has historical priority over the earliest known Greek and Roman 'Enoch Zodiac' sundials now to be presented. To recap, Table 4.1, below, summarises the 'Enoch Zodiac' scheme. The month numbers correspond to the solar gate numbers described in *1 En.* 72:2–34 and 4Q208–4Q211.

As shall be shown, this scheme is also a basic inscriptional arrangement in Greek and Roman sundials. In the case of most of the sun dials surveyed in this chapter, the 12 zodiac signs that the sun traverses during the year are organised in numerical order from Gate 6 to Gate 1, in parallel pairs from the solstices, thereby agreeing with the 'Enoch Zodiac' scheme (see Figure 4.1). The summer solstice occurs in Gate 6, when the sun moves from Gemini into Cancer in June and July,

1 Strabo, *Geography*, Bk 1.1.20 (Jones, LCL).

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TABLE 4.1 *The 'Enoch Zodiac' from* 1 En. *72:2–34*

Gate	Month	Zodiac sign	Zodiac sign	Month	Gate
6	IV	Cancer	Gemini	III	6
5	V	Leo	Taurus	II	5
4	VI	Virgo	Aries	I	4
3	VII	Libra	Pisces	XII	3
2	VIII	Scorpio	Aquarius	XII	2
1	IX	Sagittarius	Capricorn	X	1

its northern-most and highest position in the sky. Gate 1 corresponds to the months of the winter solstice, December and January, when the sun moves from Sagittarius to Capricorn, is at its southern-most and lowest position of in the sky. In *The Book of Luminaries* Month I is aligned with Gate 4 "the great gate," the spring, or vernal, equinox (*1 En.* 72:6).[2]

The zodiac dials are sun clocks as well as crude zodiac calendars that tell the month; the shadow cast by the sun varies according to the season of year, and the time of the day. The solstices and equinoxes as well as the hour of the day are often determined by the sun's shadow usually by means of a gnomon. The dial imitates the curve of the earth's surface (see Figs. 4.4.2, 4.4.3).

The solstices and equinoxes and the months in between are marked on the surface on the dial as horizontal date curves, determined by the angle of the sun on the horizon at the solstices and the equinoxes. A straight east-west

2 Neugebauer, *The 'Astronomical' Chapters,* Translation, 6, Comment, 12, he notes that the increase in the length of daylight from 9 parts to 10 parts (*1 En.* 72:10) implies that the year begins at the vernal equinox, as in Babylonia. VanderKam, *1 Enoch* 2, 423, Comment to *1 En.* 72:6. VanderKam observes: "The sun rises in the first month in the fourth gate, which is designated 'the great gate.' There is no indication elsewhere that the gates were conceived as being of different in size, so the word 'great' ((*ābiy*) should have a nuance other than 'large(r).' Here it probably means 'important,' 'notable,' or the like, and labelling the fourth gate as notable/great arises from the fact that the year begins with the sun emerging from it." However, this chapter shows that in fact the fourth gate of Aries and Virgo is also the largest in the network of lines on the Mediterranean zodiac sundials. Although Gate 4 is the portal for the year beginning at the spring equinox, it is also the portal for Month VI, September-Virgo the autumn equinox. Therefore, the larger size of the Aries-Virgo area on the sundials should not be ruled out as a possible spatial and cosmological reference to Gate 4 when applied to ancient instruments that measure time in daylight hours at their geographical latitude.

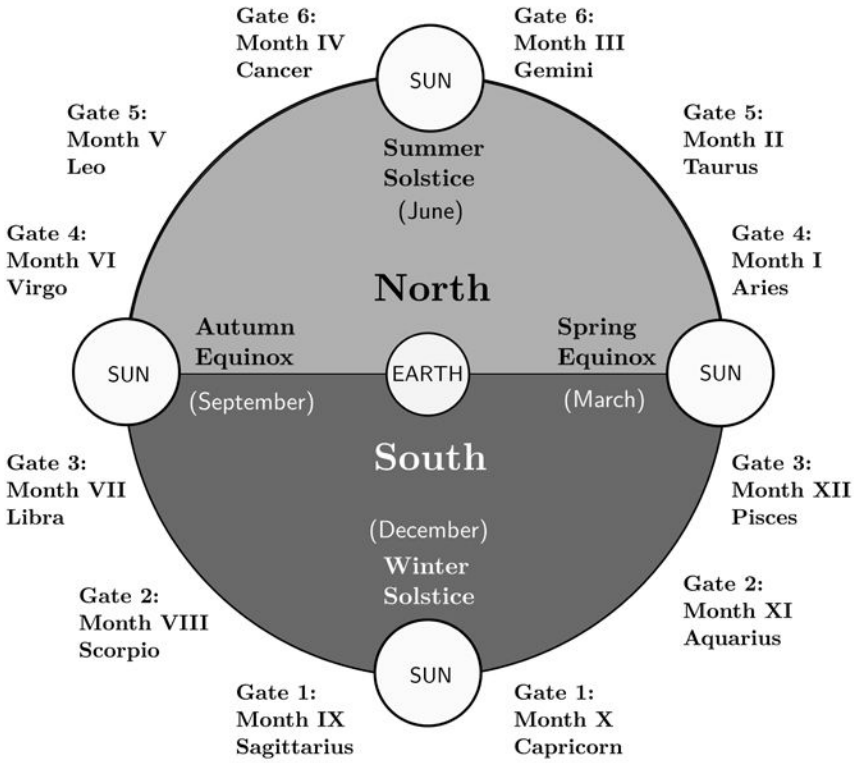

FIGURE 4.1 *The apparent journey of the sun through the solstices and equinoxes.*

line marks the shadows at the equinoxes. The hour lines are marked vertically between the solstitial day curves. The shape of the grid arrangement of hour lines and the solstitial day curves are determined by the latitude of the dial and the altitude of the sun. The instruments have a central vertical meridian line, which catches the sun's shadow when it is directly overhead at noon.

The length of the meridian line is determined by the shortest shadow, which takes place at the summer solstice when the sun is at its maximum height, directly overhead, in the northern hemisphere. The longest noon-day shadow falls at the winter solstice when the sun is at its lowest point, near the horizon.[3]

3 I.K. McEwen, *Vitruvius: Writing the Body of Architecture* (Cambridge, MA: MIT Press, 2003), 245; J. Evans, *The History and Practice of Ancient Astronomy* (New York, Oxford University Press, 1998), 133–135.

The hour lines are arranged before and after the noon line, and are read from the west side (from sunrise) to the east side (sunset), the reverse of the sun's apparent movement from east to west as the shadows are opposite the sun.

On the dials examined in this chapter the eastern and western zodiac signs of Gates 1 to 6 are separated by the meridian, or noon, line. They are carved, engraved, or inlaid on either side of the line. The inscriptional zodiac sign names are sometimes abbreviated to accommodate the network of lines, to fit into the spatial area allotted for the sun's shadow for the hour at that time of year. The sun's elliptical orbit means that depending on the season, its position overhead will also be more easterly or westerly as well as high or low.[4] The solar zodiac signs inscribed on all the sundials presented in this chapter either run from Gate 6, the summer solstice months, at the top, to Gate 1, the winter solstice months, at the bottom, or the other way round, depending on where the dial was placed.

As noted below (note 2), in the zodiacal Greek and Roman sundials, Gate 4, "the great gate," of Aries and of Virgo, and Gate 3, of Pisces and of Libra have the widest spaces due to the latitude of the dial. The different types and designs of the 'Enoch Zodiac' dials, as well as the other kinds of zodiac dials mentioned in this chapter, are quite fascinating. The 'Enoch Zodiac'model appears in surviving Greek and Roman sundials containing the zodiac from the late second century B.C.E. to the first century C.E., and late antiquity.[5] The earlier models may be contemporaneous with 4QAstronomical Enoch[a] (4Q208), depending on the manuscript's date.[6]

4 The late first-century B.C.E. scientific writer Vitruvius explains the different lengths of the sun's circuit in *Ten Books On Architecture*, Book 9, Chapter 3, lines 1–3 (trans. I. Rowland; commentary and illustrations N.H. Howe; Cambridge: CUP, 1999), 112–113.

5 S.L. Gibbs, *Greek and Roman Sundials* (New Haven: Yale University Press, 1976), 86, cat. no. 7002G: 27–30, 376–377, pls. 62–64, photos, p. 378. C.W. Blegen, "Prosymna, Remains of Post-Mycenaean Date," *AJA* 43:3 (1939): 410–444 (443–4, fig. 31); Gibbs, *Greek and Roman Sundials*, Gibbs cat. no. 1068G: 183, pl. 15, photo, p.188; idem, Gibbs, cat. no. 4007: 331, drawing (ref: G. Fiorelli, "Di un orologio solare in marmo," *Giornale degli Scavi di Pompei* 3 (1865): 14–16); idem, Gibbs, cat no. 4010 (Mausoleum of Augustus, Rome): 333 (drawing); J. Evans, "Gnōmonikē Technē: The Dialer's Art and its Meaning for the Ancient World," in *The New Astronomy* (ed. Wayne Orchiston; ASSL, 334:4; Dordrecht: Springer, 2005), 273–292.

6 Although paleographically dated to the late third or early second century B.C.E. by Milik, *BE*, 273–274, the carbon-dating results range from the second to the mid-first century B.C.E.: Jull et al., "Radiocarbon Dating of Scrolls," 14, the highest probability is: 186–92 B.C.E.; cf. Carmi, "Radiocarbon Dating of the Dead Sea Scrolls," 886, places a lower value on the date-range: 120–55 B.C.E.

4.2 Questions of Transmission

Vitruvius reported that "Berossus the Chaldean" invented the prototype semicircular sundial "carved out of a square block and undercut to follow the earth's tilt,"[7] in addition to teaching how to construct a horoscope.[8] Other sources aside from Vitruvius ascribe the teaching of astrology to the Greeks by Berossus on the island of Kos in the mid-third century B.C.E.[9] Drews argues that there were probably two men named Berossus, one who authored the legendary-historical work, the *Babyloniaca*, in the early third century B.C.E., which he dedicated to Antiochus I, and the other who taught astrology on Kos later on.[10] Kuhrt supports this opinion on the basis that the astronomical fragments attributed to Berossos represent Hellenistic-Greek scientific knowledge.[11] Verbrugghe and Wickersham, who represent a minority view, suggest that there no contradiction in the two accounts particularly since Babylon under the Seleucids became "an intellectual backwater." They argue that the same person could have emigrated to Kos, then under Ptolemaic control. They further note that according to Josephus, the historian Berossus also wrote about ancient Babylonian astronomy. In their view, he probably did not write on astronomy separately and his historical work shows his interest in ancient wisdom.[12] At the other extreme, G. de Bruecker, agreeing with Kuhrt, claims that the Berossos of Kos is a "creation of the Hellenistic period, a time in which the origins of Hellenistic sciences like astrology and alchemy were traced back to the Orient."[13] In partial agreement, Steele states that Vitruvius named Berossos

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7 Vitruvius, *On Architecture* 9.8.1 (trans. Rowland, *Ten Books On Architecture,* 116).

8 Vitruvius, *On Architecture* 9.6.2. The attribution of the transmission of astrology by Berossus from "the nations of the Chaldeans" on the island of Kos, (trans. Rowland, *Ten Books On Architecture*, 115) c. 270 B.C.E.; Gibbs, *Greek and Roman Sundials*, 60; G.P. Verbrugghe and J.M. Wickersham, *Berossus and Manetho Introduced and Translated* (Ann Arbor, MI: University of Michigan Press, 2001), 13–15.

9 See Verbrugghe and Wickersham, *Berossus and Manetho*, 35–41: other testimony includes Pliny the Elder, *N.H.* 7.123 and Josephus, *Ag. Ap.* 1.128–31.

10 R. Drews, "The Babylonian Chronicles and Berossus," *Iraq* 37 (1975): 39–55 (esp. 51–52).

11 A. Kuhrt, "Berossos' *Babyloniaka* and Seleucid Rule in Babylonia," in A. Kuhrt and S.Sherwin-White, eds. *Hellenism in the East: the Interaction of Greek and non-Greek Civilizations from Syria to Central Asia after Alexandria* (Berkeley: University of California Press, 1987), 32–56 (esp. 36–44).

12 Verbrugghe and Wickersham, *Berossus and Manetho*, 13–15.

13 Geert de Bruecker, "Berossos between Tradition and Innovation," in *The Oxford Handbook of Cuneiform Culture* (ed. Karen Radnor and Eleanor Robson; Oxford: OUP, 2011), 637–662 (esp. 643). For an alternative opinion see B.J. Van der Spek, "Berossos as a Babylonian

with respect to sundials to lend authority to the subject matter that followed and that there was no historical basis for the attribution.[14]

Herodotus (fl. 450s–420s B.C.E.) also attributes the introduction of the sundial, the gnomon, and the 12 divisions of the day to Greece, from Babylon.[15] Gibbs states that on one hand, this may be a gloss as Neugebauer and Parker argue that the measurement of seasonal hours originated in Egypt; however, she also states that Herodotus is the earliest known witness and that his evidence is "consistent" with the testimony of Vitruvius, that is, that the Greeks imported the 12 parts of the day and the πόλος (*pólos*) and γνώμων (*gnomon*) from Babylonia.[16] She observes that that there were few, if any, sundials in Greece before the third century B.C.E.[17] The remainder of Vitruvius's list of inventors of sundials and water clocks consists of Hellenistic astronomers and mathematicians.[18] For Toomer, the transmission of astronomical knowledge from Mesopotamia to Greece was much later. He contends that it was Hipparchus (fl. C. 150 B.C.E.) who brought Babylonian astronomy and astrology to the Greeks,[19] summarising his position as follows:

> Astrology had no importance in the Greek world until after Hipparchus. His role both directly as an advocate of astrology and indirectly as a developer of astronomical methods, which became an essential part of it, was pivotal.[20]

Chronicler and Greek Historian," in *Studies in Ancient Near Eastern World View and Society Presented to Marten Stol on the Occasion of his 65th birthday* (ed. R J. Van der Spek et al.; Bethesda, MD: CDL Press, 2008), 277–318.

14 J.M. Steele, "The Astronomical Fragments of Berossos in Context," in *The World of Berossos* (ed. J. Haubold et al.; Wiesbaden: Harrassowitz, 2013), 107–120, esp. 118–119.

15 Herodotus, *Hist.* 2.109 (trans. Aubrey de Selincourt; revd. by John Marincola; London: Penguin, 2003), 136.

16 Gibbs, *Greek and Roman Sundials*, 6, 60. The is the name for the axis of the celestial sphere, the pivot on which anything turns; it is the name of the concave sundial, so-called because it is shaped like the vault of heaven, on which the shadow was cast by the *gnomon*, s.v. πόλος. H.G. Liddle and R. Scott, *A Greek-English Lexicon* (Oxford: Clarendon Press, 1932), 2.1:1436, §4.

17 Gibbs, *Greek and Roman Sundials*, 7; Evans, "The Dialer's Art," 285–286.

18 Vitruvius, *Ten Books On Architecture* 9.8.1–2 (trans. Rowland), 116.

19 G.J. Toomer, "Hipparchus and Baylonian Astronomy," in *A Scientific Humanist: Studies in Memory of Abraham Sachs* (ed. E. Leichty et al.; OPSNKF 9; Philadelphia: S.N. Kramer Fund, 1988), 353–362.

20 Toomer, "Hipparchus and Babylonian Astronomy," 362.

The question of the transmission of the 'Enoch Zodiac' to or from Judea and Qumran has several possible pathways. The problem may be posed as follows, whether the Greeks:

a) Learned the 'Enoch Zodiac' of the sundials directly from the Babylonians possibly during the period of Berossos, or Hipparchus. If so, this may have been by way of Aramaic as an intermediate language for the exchange of scientific knowledge in Judea where it was preserved and survived.

There are problems with this theory since there is no archaeological support for an 'Enoch Zodiac' sundial from Mesopotamia or Palestine, while they noticeably spread in Greece, Italy and another kind of zodiac dial emerged in Ptolemaic Egypt, discussed later. Although the so-called "Graeco-Babyloniaca tablets" (dated 50 B.C.E.–50 C.E.)[21] suggest that Greek may have been suitable as a vehicle for transcribing Akkadian vowels phonetically,[22] there is no evidence that Greek was a medium for the cultural transmission of Babylonian astronomy in Aramaic to Judea. One may suggest alternatively,

b) The 'Enoch Zodiac' originated in the Greco-Roman world where we find it in the zodiac sundials. It was probably disseminated to Judea where the sun's and the moon's 'gates,' numerical substitution for the months and zodiac signs from late Babylonian texts, appear in *4QAstronomical Enoch*$^{a-d}$ (4Q208–4Q211).

Terminology pertaining to the heavenly gates is not apparent in Greco-Roman science and although it is a recurring motif in Sumerian and Akkadian poetic and cosmological imagery,[23] it seems to be absent from known Babylonian mathematical, astronomical and calendrical texts. Based on the

21 Westenholz, "Graeco-Babyloniaca," 274–275.

22 Westenholz, "Graeco-Babyloniaca," 277; Paul-Alain Beaulieu, "Official and Vernacular Languages: The Shifting Sands of Imperial and Cultural Identities in First Millennium B.C. Mesopotamia," in *Margins of Writing, Origins of Cultures* (ed. S.L. Sanders; University of Chicago Oriental Institute Seminars 2; Chicago: Oriental Institute, 2006), 187–216, at 207 [reference cited in Ben-Dov, *Head of All Years*, 261 n. 40].

23 Horowitz, *Cosmic Geography*, 266–267; in the Descent of Ishtar, the goddess travels through seven gates in the underworld and back up again though the gates, S. Kramer, "Descent of Ishtar to the Underworld," *ANET*, 106–109; translated as "doors" in S. Dalley, *Myths from Mesopotamia*, 154–162. On the association of Ishtar with the role of Venus in a possible cultic calendar of Nineveh, S. Dalley, *Esther's Revenge at Susa* (Oxford: Oxford University Press, 2007), 137–64; and Ishtar as Venus, K. Jakubiak and A. Sołtysiak. "Mesopotamian influences on Persian sky-watching and calendars. Part II. Ishtar and Anahita," *Archaeologia Baltica* 10 (2008), 45–51. E. Gehlken, *Weather Omens*, "gates" are the openings in the rings of a halo or a corona, p. 83, n. 5, and with reference to *EAE* tablet 46, 66' D. r. 26, p. 110, n. 41.

textual and extant archaeological evidence dating from the second century B.C.E., it could be argued that *4QAstronomical Enoch*$^{a-d}$ would have been copied or composed within the milieu of the huge growth in the popularity of sundials in the ancient Mediterranean.

The rapid growth of interest in sundials of very different kinds over a three to four hundred year period is attested in several literary and scientific sources of the time in addition to the archaeology.[24] Their design and production continued in later antiquity: dials, in many types, shapes and sizes, with and without a zodiacal element, appear to have been plentiful, fashionable, and part of the cultural and material landscape of Greek and Roman societies.[25]

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24 Evans, "Gnōmonikē Technē," 273–292; Evans, *History and Practice*, 129–141; Gibbs, *Greek and Roman Sundials*, 5–11; Vitruvius, *On Architecture* 9:8.1, describes the different kinds of sundials and names their inventors; Pliny, *Natural History* 2.182–188 (Rackham, LCL [v.1]), explains how travellers' sundials work at differing latitudes and times of day. In a comedy attributed to Plautus (250 B.C.E.–184 B.C.E.) a hungry parasite complains about the advent of the sundial: "May heaven blast the man that first invented hours, yes, and first set up a sundial here—and minced the day into mere nothings for me, curse it! Why, when I was a boy my only sundial was my belly, and it was easily the best and most reliable timepiece of 'em all. On its giving you notice, you'd eat, except when there was no food; now, even when there is it isn't eaten, unless it suits old Sol. Tiy, we've reached the point where this town's stuffed with sundials—while most of its citizens creep about all shrivelled up with emptiness," Plautus, *The Boeotian Woman* (Fragment 21v) (Nixon, LCL) online: https://archive.org/details/plautuswithenglio5plauuoft , quoted by Aulus Gellius (second century C.E.), *Attic Nights* 3.3.5. (Rolfe, LCL); J.W. Humphrey et al., *Greek and Roman Technology: A Sourcebook. Annotated Translations of Greek and Latin Texts and Documents* (London: Routledge, 1998), 517–518.

An early fourth century B.C.E. dramatic reference connecting sundials and mealtimes can be found in Aristophanes, *Eccl.* 651–2 (Rogers, LCL) [when the shadow reaches ten-foot on the dial it is time for dinner]. Hannah explains that the shadow-lengths are human shadows, measured out by human feet, idem, *Time in Antiquity*, 75–80, citing further classical literary extracts. He has published a Byzantine shadow table showing that pairs of zodiacal months corresponding to the Aries–Virgo ("Enoch Zodiac") scheme, in which the pairs of shadow lengths from morning to evening and vice-versa at opposite ends of the day are the same: CCAG 7: 189.11–24 (the document is the form of a letter from a Sextus, the *hōrokrator* {"ruler of hours"} to a King Philip), in idem, *Time in Antiquity*, 79–80. The signs on the ecliptic, therefore, correlate to the rising and setting signs on the horizon. Hannah argues that the zodiacal months as markers on sundials could not have existed on Greek dials before 300 B.C.E., the earliest date in Greek texts that the zodiac was divided into 30° segments.

25 Gibbs states that some 30 sundials have been uncovered in excavations at Pompeii, *Greek and Roman Sundials*, 5. She quotes a humorous epigram attributed to Trajan (52–117 C.E.) epitomising the novelty value that still existed in the first century, from *Anthologia Graeca*

4.3 Sundials in Greco-Roman Astrology

The "Enochian" arrangement of the zodiac signs differs from the geometrical relationships in circular zodiacs described by the poet, Manilius. The astrological system that he described comprised a zodiac circle in which:

> Aries the Ram is diametrically opposite Libra the Scales;
> Taurus the Bull (Heb: Ox) is diametrically opposite Scorpio the Scorpion;
> Gemini the Twins are diametrically opposite Sagittarius the Archer;
> Cancer the Crab is diametrically opposite Capricorn the Sea Goat (Heb: Kid);
> Leo is diametrically opposite Aquarius the Water Carrier (Heb: Bucket)
> Virgo the Virgin is diametrically opposite Pisces the Fishes.[26]

Vitruvius also refers to this arrangement when he describes the zodiac signs in terms of constructing sundials and "winter clocks."[27] This way of looking at the zodiac became the blueprint for the traditional arrangement of zodiac signs in horoscopes and it continued in depictions of the zodiac, for example, the well-preserved sixth century C.E. Beth Alpha synagogue zodiac (see Figure 4.3a), is illustrative of the diagonal zodiacal arrangement described by Manilius.

The earliest surviving example of the circular horoscope arranged with diametrically opposing signs is described and illustrated in a diagram at the bottom of a Greek horoscope text in the Roman Egyptian papyrus, Oxyrhynchus, P.Oxy 235 (see Figure 4.3b). The manuscript is dated to c.15–22 C.E., or alternatively to the first half of the first century.

The diagram, or birth chart, is described as "unique" by Grenfell and Hunt, who published the first transcription of the detailed astrological text. Neugebauer and Van Hoesen published the first copy of the horoscopic diagram with the transcription and translation of the text, depicting the chart accurately, as it appears in the papyrus without the inclusion of Venus and Jupiter, whose positions are detailed in the text.[28] There is no reason given in

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11. 418, "If you put your nose pointing to the sun and open your mouth wide/ you will show all passers-by the time of day," see *Greek and Roman Sundials*, 1, from *The Greek Anthology. Books 10–12* (trans. W.R. Paton; LCL 85; Cambridge, MA: Harvard University Press).

26 Manilius, *Astronomica* 2.270–432 (Goold, LCL), xli–xlv; 105–117.

27 Vitruvius, *Ten Books On Architecture* 9.7.1 and 9.8.12–15 (trans. Rowland), 115, 117–118; see sub-section B.C.E. 9. on Vitruvius's "water clock."

28 O. Neugebauer and H.B. Van Hoesen, *Greek Horoscopes* (Philadelphia: APS, 1987), 18–19, cat. no. P.Oxy 235, 15/22; dated 20 C.E. in B.P. Grenfell and A.S. Hunt, *The Oxyrhynchus*

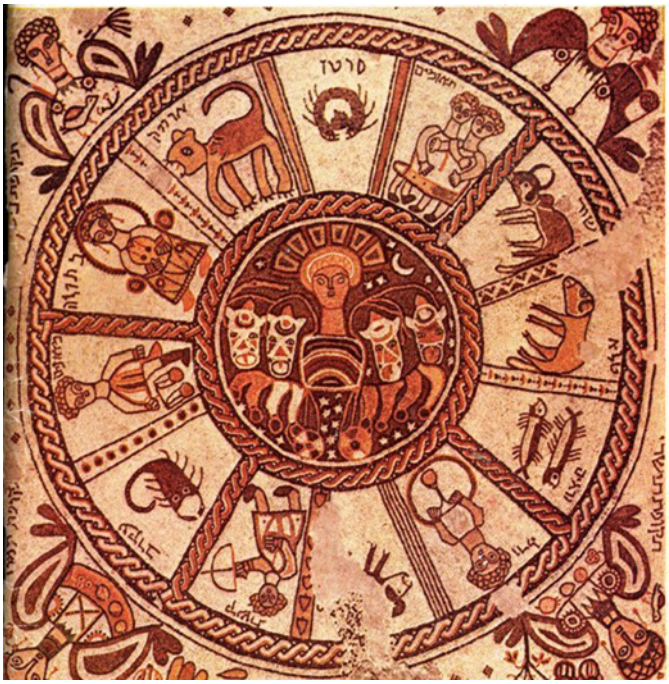

FIGURE 4.3a *The signs of the zodiac at the Beth Alpha synagogue.*[29]

the ancient astrologer's report for the anomaly. The horoscope chart is copied below (see Figure 4.3) with a translated duplicate (the lower illustration). I have also included the missing data, that is, the positions of Venus and Jupiter in the chart as described in the text, for information purposes.

Rules were drawn between four signs, Taurus–Scorpio, Aquarius–Leo to indicate these important points in the horoscope chart. The bisecting lines also show that these signs, 180° apart, are pairs. The east to west line represents the horizon; the perpendicular meridian, or noon, line extends from the upper midheaven to the lower midheaven. Taurus, the rising sign, or *Horoscope*, ωρσκπει (P.Oxy 235 line 13) is on the left-hand side, representing the east, with

Papyri. Part II (London: Egypt Exploration Fund, 1899), 137–139 and front matter, Table of Papyri. Dated 15–50 C.E. in the Cambridge University Library (catalogue no. P.Oxy II 0235). James Evans suggests this diagram on papyrus was a drawing of a three-dimensional "Astrologer's Board" which used semi-precious stones to represent the planets, see, "The Material Culture of Greek Astronomy," *JHA* 30 (1999): 237–307 (at 287–288).

29 The Beth Alpha synagogue zodiac mosaic. Download from Wikipedia Commons. http://upload.wikimedia.org/wikipedia/commons/b/b2/Beit_Alpha.jpg , accessed 15 January 2013.

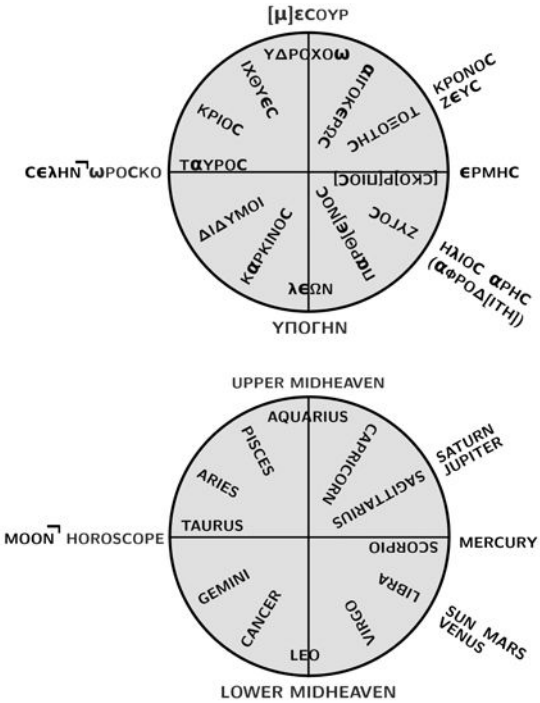

FIGURE 4.3 *P.Oxy 235. Upper: copy of earliest diagram of a nativity chart using Neugebauer and Van Hoesen's transcription (with Venus and Jupiter added according the text). Lower: translation.*

the moon (meaning that the moon was rising at the time the child was born). Taurus is opposite the zodiac sign of Scorpio (P.Oxy 235 line 15), which is written upside down, presumably to indicate that it is setting, on the right hand side of the diagram, the west. Mercury is in Scorpio at this point. The upper midheaven is in Aquarius (P.Oxy 235 lines 13–14) directly opposite the lower midheaven in Leo (P.Oxy 235 lines 15–16).[30]

In Greek astrology, one of the purposes of computing daylight times was to calculate the variable rising times of the different zodiac signs over the eastern horizon, to determine the sign of the Horoscope, the ascending zodiac sign.[31] The astrological techniques could involve the use of sundials to measure hours, and hence the time taken for the zodiac signs to rise (a longer time

30 Manilius, *Astronomica* 2.826–830; 3.190, 200, 518, 538, 608; 3.203–509; 3.296 (Goold, LCL).

31 Manilius, *Astronomica* 3.295–300 (Goold, LCL).

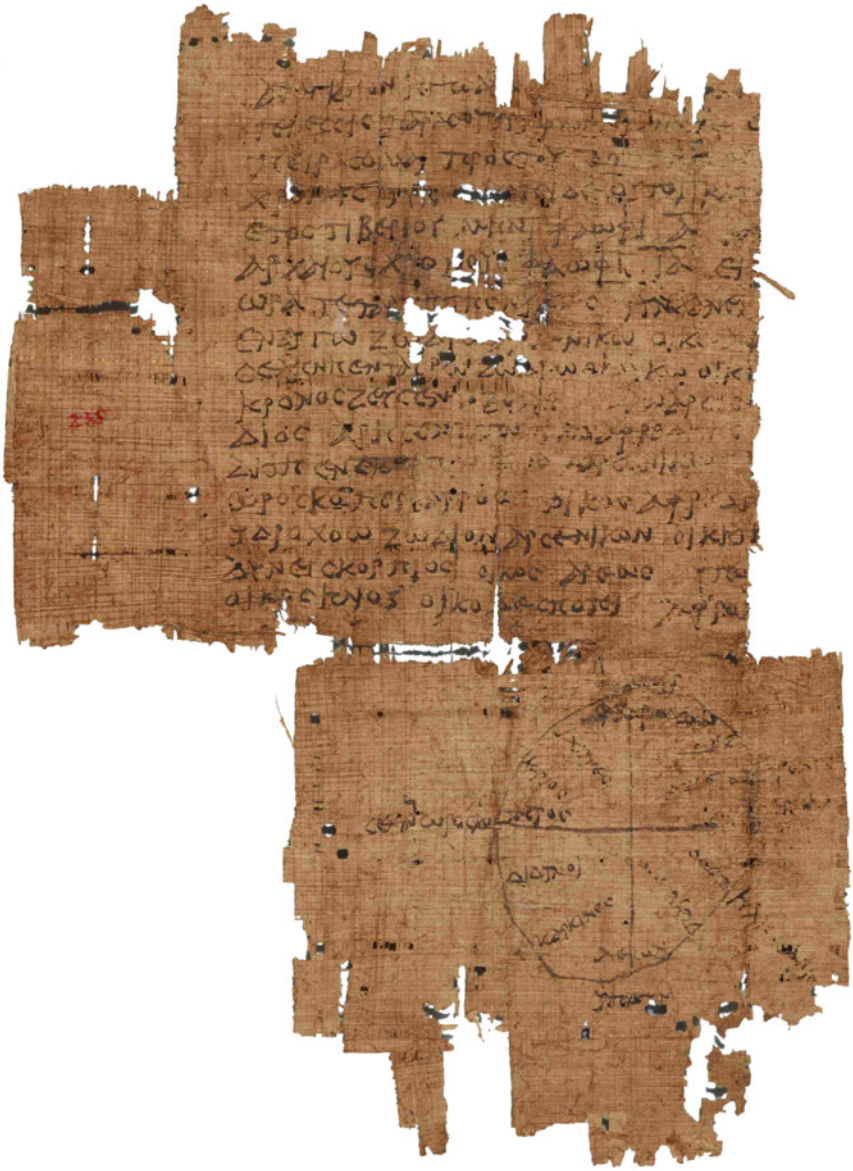

FIGURE 4.3b *P.Oxy 235. First century horoscope with a diagram.*

in the summer, a shorter time in the winter).[32] The seasonal hour of the day determines which zodiac signs were rising at any given time.[33] The zodiacal rising times are needed to calibrate the Horoscope in increments, or degrees.[34] Lengths of variable daylight schemes according to the geographical location, the latitude, are also well known from Greco-Roman parapegmata[35] from the detailed works such as that of Geminos[36] and Manilius,[37] as well as from Mesopotamian astronomy-astrology.[38] According to Manilius, when the sun is at the first degree of Cancer (summer solstice) at the latitude of Rhodes, the daylight length is 14 and half hours and the night-length is nine hours;[39] the day and night lengths are reversed for the winter solstice. A calendar engraved on the base of a Greco-Roman sundial (age, provenance and present location unknown) states that the longest day is equal to 15 hours.[40]

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32 Manilius, *Astronomica* (Goold, LCL), Introduction, lxviii. Sundial hours, or seasonal hours, varied according to the time of year: the day (and night) was divided into 12 hours which would be longer or shorter, depending on the day length—Babylonian daylight hours grow longer from the vernal equinox to the summer solstice, and so on—see Glessmer and Albani, "An Astronomical Measuring Instrument," 420.

33 Manilius, *Astronomica* 3.301–3.442 (Goold, LCL). (See Figure 4.4.10. The Astronomical Clock, Prague).

34 Neugebauer and Van Hoesen, *Greek Horoscopes*, 3–4, 7, 170; Ptolemy, *Tetrabiblos*, 3.2 (Robbins, LCL). Manilius, *Astronomica* 3.203–509 (Goold, LCL).

35 For example, the early 3rd-century Ptolemaic parapegma P. Hibeh 27, re-edition in D. Lehoux, *Astronomy, Weather, and Calendars*, 217–223. An extract: "Epiphi 23: Autumnal equinox; the night is 12 hours, the day 12. Feast of Anubis . . ." (English translation, 222), see Chapter 5.

36 Geminos, *Introduction to the Phenomena* 4:29–49 (trans. Evans and Berggren), 165–168.

37 Manilius, *Astronomica* 3.301–384 (Goold, LCL), Introduction, lxix–lxxvii. Neugebauer states that Manilius confuses his data for "System A" and "System B" and mixes up the geographical localities "always without informing the reader," See *HAMA*, 718; also, Evans, *Theory and Practice*, 124–125.

38 Aaboe and Sachs, "Two Lunar Texts," 1–22; F. Rochberg-Halton, "Elements of the Babylonian Contribution to Hellenistic Astrology," *JAOS* 108 (1988): 51–62; O. Neugebauer, "The Rising Times in Babylonian Astronomy," *JCS* 7.3 (1953): 100–102; See F. Rochberg, "Babylonian Seasonal Hours," *Centaurus* 32 (1989): 146–170; "A Babylonian Rising Times Scheme in Non-Tabular Astronomical Texts," in *Studies in the History of the Exact Sciences in Honour of David Pingree* (ed. Charles Burnett et al.; Leiden: Brill, 2004), 56–94. (Both papers republished in F. Rochberg, *In the Path of the Moon*, Leiden: Brill, 2010), 167–188, 271–302).

39 Manilius stated "the land of the Nile," presumed to be Alexandria; according to Goold, this is an error, *Astronomica* 3.271 (Goold, LCL), 182–183. See also Neugebauer, *HAMA*, 708–709, 715 above.

40 S.L. Gibbs, *Greek and Roman Sundials*, 390 (catalogue no. 7007).

There were also vulgar methods which allowed astrologers to compute a rough ascendant, or zodiacal rising time, for any location, without making use of a sundial. Manilius gives a rule-of-thumb for such a method, allowing a mean two hours for each sign to rise:[41] counting from the sign rising at sunrise (which is cognate with the month-sign), while also expressing his disapproval of the use of the "common method."[42] He explained that the vulgar method of computation was inaccurate because it takes no account of the variations in the times that signs take to rise in different seasons, and the variable length of daylight hours.[43] Nonetheless, it is interesting that he placed the "common method" on record (possibly for the benefit of astrologers at all levels of practice). Brind'Armour argues that another vulgar method introduced by Manilius for converting sundial hours into a table of day lengths and rising times in order to compute the ascendant is probably a gloss.[44]

Neugebauer did not comment on the different arrangements of the pairs of zodiac signs: between the diagonally opposite signs found in P.Oxy 235 and signs opposite each other from the two solstice points, found on many Greco-Roman sundials, as shall be shown. With regards to astrology and early sundial theory, he commented on a misappropriated reference to Hipparchus to

41 Manilius, *Astronomica* 3.306–308 (Goold, LCL).

42 Manilius, *Astronomica* 3.218–224 (Goold, LCL). The poet may have had in mind that emperors would read his work: Augustus and Tiberius receive veiled astrological praise, *Astronomica*, "Introduction," xii. However, as stated, Manilius was himself inaccurate when he confused two different Babylonian rising-times schemes, *Astronomica* 3.275–294 (Babylonian "System A") and 3.443–482 (Babylonian "System B"), Evans, *Theory and Practice*, 124 nn. 46, 47.

43 Manilius, *Astronomica* 3.225–246 (Goold, LCL).

44 Pierre Brind'Amour, "Manilius and the Computation of the Ascendant," *Classical Philology* 78.2 (1983): 144–148. Brind'Amour is of the opinion that a scheme for calculating the Horoscope outlined in Manilius (*Astronomica* 3.483–509) (multiplying the sundial time by 15 to compute the number of degrees rising), may be an interpolation because of Manilius's condemnation of the first method described above (3.218–246). Yet, as suggested above, other interpretations are possible: Manilius may have diplomatically condemned easier, less accurate methods of computations, on one hand, as befits a royal astrologer, but still recorded them for the benefit of fortune-tellers; see Cicero, *On Divination* 1.132 (Falconer, LCL) for evidence of "astrologers who haunt the circus grounds" which Cicero attributes to a play by Ennius (alternative numbering, 1.58: online. Cited 24 December 2012. http://penelope.uchicago.edu/Thayer/E/Roman/Texts/Cicero/de_Divinatione/1*.html); D. Wardle, *Cicero: On Divination. Book 1* (Oxford: Clarendon, 2006), 88–89.

See also A.T. Nice, "Ennius or Cicero? The disreputable diviners at Cicero, *De Divinatione* 1.132," *Acta Classica* 44 (2001): 153–166.

"*antiscia*," an "astrological term," by the fourth century C.E. astrologer Firmicus Maternus, as follows:

> Fortunately, we do not need to describe here what this astrological term means beyond that it implies pairing opposite points of the ecliptic in directions parallel to the equinoctial or solstitial diameter. I do not think it out of the question that there exists some relation to the early theory of sundials since one of its coordinates is called 'antiskion,' but I see no connection with any known work of Hipparchus.[45]

The literal meaning of the term is "counter-shadow," from the Greek, σκιά: *shadow*.[46] The astrological term refers to the longitude of two planets positioned in opposite pairs of signs in the Aries–Virgo zodiac, which are "said to throw shadows on each other."[47] The 'Enoch Zodiac' model appears in Maternus' treatise *Mathesis*, Book 2, chapter 29,[48] and according to Tester, it may be derived from Ptolemy's concept of signs which behold each other βλέποντα, (*Tetrabiblos*, Book 1.15).[49] Interestingly, Ptolemy explains the concept of "beholding" in terms of sundial theory, with a statement that each in the pair of signs concerned rises and sets in the same part of the horizon.

> . . . because each of the pair rises from the same part of the horizon and sets in the same part.[50]

Neugebauer stated that Ptolemy mentioned the *antiscion* in his treatise, *On the Analemma*,[51] with regards to the theory of sundials. Elsewhere, Neugebauer informs us that Ptolemy's information in this text either did not exist, or if it did, it has not survived.[52] Robbins states that Ptolemy was referring to zodiacal pairs in the scheme: Gemini–Leo, Taurus–Virgo, Aries–Libra, Pisces–Scorpio,

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45 Neugebauer, *HAMA*, 331.

46 S.C. Woodhouse, *English-Greek Dictionary: A Vocabulary of the Attic Language*. (London: Routledge, 1910), 760; Liddle and Scott, *A Greek-English Lexicon*. 2.2:1609.

47 Tamsyn Barton, *Ancient Astrology* (London: Routledge, 1994), 99, fig, 17.

48 Firmicus Maternus, *Ancient Astrology Theory and Practice. Matheseos Libri 8* (trans. Jean Rhys Bram; Park Ridge, NJ: Noyes Press, 1975 {reprint Bel Air, MD: Astrology Classics, 2005}), 58–68.

49 Tester, *A History of Western Astrology*, 133–136; Ptolemy is believed to have been born in Ptolemaïs and lived in Alexandria or Canopus, Ptolemy, *Tetrabiblos* (Robbins, LCL), vii, viii.

50 Ptolemy, *Tetrabiblos* 1.15 (Robbins, LCL).

51 Neugebauer, *HAMA*, 1.331 n. 9.

52 Neugebauer, *HAMA*, 2.839–840.

Aquarius–Sagittarius, leaving Cancer and Capricorn without a partner (see Table 4.3).[53] Robbins's suggested scheme is found in two of the ancient sundials shown later in this chapter: the ivory sundial from Tanis in Egypt (and the later, ivory diptych dials) and the roofed dial from Roman Carthage. These zodiac schemes also do not coincide with the 'Enoch Zodiac' and must derive from a different tradition. A similar scheme to the *Tetrabiblos* 1.15 arrangement (as per according to Robbins) can be found in a cuneiform lunar text in a column which records a linear daylight scheme, months, numbers and the corresponding zodiac signs (BM 36822 + BM 37022); the tablet is dated to the regnal period of Artaxerxes II, c. 400 B.C.E.[54]

TABLE 4.3 *The distribution of zodiac signs in Ptolemy's* Tetrabiblos. *1.15, according to Robbins*

	Cancer	
Gemini		Leo
Taurus		Virgo
Aries		Libra
Pisces		Scorpio
Aquarius		Sagittarius
	Capricorn	

The arrangement in *Tetrabiblos* 1.15 will be referred to under that name to distinguish it from the 'Enoch Zodiac' sundial scheme.

4.4 Introduction to 'Enoch Zodiac' Sundials

This section will examine five extant dials from the second century B.C.E. to the first or second century C.E., which feature the 'Enoch Zodiac' and two sundials, which appear to be based on the '*Tetrabiblos* 1.15' scheme. I have not found any ancient zodiacal sundials that reproduce the Aries-diagonally-opposite-Libra pattern found in early Greek and Roman natal astrological practice.

53 Ptolemy, *Tetrabiblos* (Robbins LCL), 77 n. 2.

54 See, A. Aaboe and A. Sachs, "Two Lunar Texts of the Achaemenid Period from Babylon," *Centaurus* 14.1 (1969): 1–22 (Text A, 3–11. Table 4); Neugebauer, *HAMA*, 709.

Just four out of the 256 Greek and Roman sundials from the third century B.C.E. to the fourth century C.E., catalogued by Gibbs explicitly include inscriptional zodiac signs.[55] One of these was found in the mausoleum of Augustus, Rome (Gibbs, no. 4010), one in Pompeii (Gibbs, no. 4007), a substantial piece in Rome (Gibbs, no. 1068G), and another important dial was discovered in Prosymna in the Argolid (the north-east Peloponnese) (Gibbs, no. 7002G). In addition to the four zodiacal dials identified by Gibbs, the letters of four signs of the zodiac engraved on the pavement of the sundial of Augustus have been excavated in the basement of a building on the former Campus Martius (Field of Mars), in Rome.[56] These five dials use varying forms of the 'Enoch Zodiac,' that is, the scheme begins with either Gate 1 or Gate 6, and there is an apparent variant in the dial found in Augustus's Mausoleum.

A miniature ivory sundial from Tanis, Egypt[57] and the decorative dial imitating a Roman drinking vessel discovered in first to second century Carthage, a zodiacal 'roofed spherical dial,'[58] each follow different variations on the scheme described in *Tetrabiblos* 1.15. It would appear from the small proportion of zodiacal sundials catalogued by Gibbs that zodiac schemes were uncommon, if not relatively rare. This sample with the exception of the small

55 Gibbs, *Greek and Roman Sundials*, 4–5, 86 (see note in Introduction). The numbers are her catalogue references.

56 R. Beck, "Cosmic Models: Some Uses of Hellenistic Science in Roman Religion," in *The Sciences in Greco-Roman Society* (ed. T.D. Barnes; *Apeiron* 27:4, 1994), 100, 104–105, fig. 2, p. 102, adapted from E. Buchner, *Die Sonnenuhr des Augustus. Nachdruck aus RM, 1976, 1980, und Nachtrag über die Ausgrabung, 1980–1.* (Mainz: Philippe von Zabern, 1982), p. 336 fig. 6 in *Die Sonnenuhr* [the pages in the 1982 monograph has both the original page numbering from journal articles and the renumbering in the reprints]; P. Heslin, "Augustus, Domitian and the so-called Horologium Augusti," *JRS* 97 (2007): 1–20, esp. 8; M. Schütz, "The Horologium on the Campus Martius reconsidered," *JRA* 24 (2011): 78–86, esp. 78; R. Hannah, The Horologium of Augustus as a sundial," *JRA* 24 (2011), 41–49.

57 J. Evans and M. Marée, "A Miniature Ivory Sundial with Equinox Indicator from Ptolemaic Tanis Egypt," *JHA* 39: 1 (2008): 1–17.

58 A "spectacular" large ornate marble scaiphe dial (or "roofed spherical dial," see Gibbs, *Greek and Roman Sundials*, 23–27; 194), found in Roman Carthage, dated to the first—second century C.E. includes the Greek zodiac signs and Julian calendar dates (Louvre, cat. no. MNE 1178); Evans, *Gnōmonikē Technē*, 280–281, refs: A. Pasquier and D. Savoie, "Du soleil et du marbre: un vase Romain à mesurer le temps," *Actualitiés du Département des Antiquités Grecques, Etrusques et Romaines*, 6 (2000). D. Savoie and R. Lehoucq, "Étude gnomonique d'un cadran solaire découvert à Carthage," *Révue d' Archéométrie*: 25 (2001): 25–34; P. Gagnaire and Charles-Henri Eyrand, "Le Scaphé de Carthage," 1–33. http://michel.lalos.free.fr/cadrans_solaires/autres_depts/paris/musee_du_louvre/scaphe_carthage/scaphe_carthage_pg.pdf.

sundial from Tanis which was found in a private house,[59] are mainly important public dials. The popularity of the zodiac in the late first century B.C.E. and early first century B.C.E. also reflected Augustus's interests in astrology; its use in Imperial Rome on a monumental scale in the Campus Martius was synonymous with the visual spectacle of cosmological and terrestrial power. A golden orb representing the sun was fixed on top of a sixth century B.C.E. Egyptian obelisk from Heliopolis to create a gnomon. Its base bore an inscription by Augustus, son of deified Julius Caesar, stating that Augustus had added Egypt to the empire, with a dedication to the sun god, Sol.[60] The obelisk with a globe at its pinnacle with a gnomon on top theatrically indicated that the Roman Empire had the authority of the cosmos—and that the pavement dial beneath, with the names of the 12 signs of the zodiac inlaid in brass, represented earthly science connected to the Divine.[61]

It is known that Vitruvius presented Augustus with a copy of his *On Architecture* in the mid 20s B.C.E.[62] By that time 4Q208 had almost certainly been written, even allowing for the latest possible date, according to radiocarbon dating tests. The question of whether the common scientific knowledge for the Greek and Roman dials and 'gates' representing zodiac signs shown in 4Q208–4Q209 came from Hellenistic Mesopotamia or Greece, may be justifiably posed. There appears to be no tradition of Babylonian number substitution in Greece, nor on the other hand, does there seem to be any kind of formalised geometrical, zodiacal arrangement in cuneiform texts.

4.4.1 *Ancient Zodiacal Sundials and the Winds*

The basic format of the grids is similar across all the dials: the solstices: Cancer and Gemini (Gate 6); and Capricorn and Sagittarius (Gate 1) are within very thin grid lines because the sun appears to move the shortest distance across the horizon from where it rises to where it sets in those months. These signs are placed at either end of the meridan line—a straight line running north-to south—which is also the noon-day line. Depending on the latitude, the equinoctial sign-pairs Pisces–Libra [Gate 3] and Virgo–Aries [Gate 4] and have

59 Found by W.M. Flinders Petrie in 1884; it had been burned and lay in the British Museum in 17 pieces until it was reassembled and studied in 2005, in Evans and Marée "A Miniature Ivory Sundial," 1.

60 McEwen, *Vitruvius*, 244–250 (pl. p. 242).

61 See Paul Rehak, *Imperium and Cosmos: Augustus and the Northern Campus Martius* (Madison: University of Wisconsin Press, 2006), 81–95 and § 4.4.6 on the Horologium and Solarium of Augustus (Rome), below.

62 McEwen, *Vitruvius*, 1.

the largest grid areas because the sun seems to move the farthest in a straight line across the horizon from where it rises to where it sets in those months. In addition to the names of the zodiac signs, several such dials have inscriptions indicating the position of the equinoxes.

The names of the winds may also be included, though not necessarily in all zodiacal dials.[63] It is worth noting that in the Ethiopic and possibly the Aramaic *Astronomical Book of Enoch*, 12 winds are assigned to the 12 heavenly gates, arranged in threes, each within four quarters of the sky (4Q210 f. 1 col. ii lines 1–10, [14 reconstructed]–18, 4Q209 f. 23 lines 1-2, 3–10);[64] the text in the fragments approximately aligns with *1 En.* 76: 3–14, 77:1–4.[65] The 12 gates from which the winds emerge is extant only in the Ethiopic, *1 En.* 75: 4–5; 76:1.

Greek and Latin scientific texts contemporary with the Dead Sea Scrolls describe different traditions of varying numbers of winds.[66] The scheme followed by Seneca (4 B.C.E.–65 C.E.) is of 12 winds corresponding to 12 compass points. These are aligned with the direction of the sunrise and sunset points at the winter and summer solstices, the sunrise and sunset points at the two equinoxes, and the two intermediary directions (Seneca, *Nat Quest*, Bk 5, ch. 16–17).[67] His cosmological description is of the horizon bisected by a meridian at right angles, forming the four cardinal points, representing the four main winds, (N, E, S, W), and of two bisecting points between these four zones, creating the directions of the other eight winds (NNE, NE, SE, SSE, SSW, SW, NW, NNW) (Seneca, *Nat Quest*, 5.16–17). The image is similar to 12 boundary lines on a circular zodiac wheel. According to Clarke, Seneca states that the Stoics believe that there are a maximum of 12 winds, although some places may receive fewer winds, and that "those that assert that the number of winds are twelve adopt the principle that the number must be the same as the divisions

63 See the dial from the Mausoleum of Augustus, Rome, below, for a zodiacal dial that includes a wind rose. The first-century B.C.E. Tower of Winds in Athens houses a zodiac water clock, J.V. Noble and D.J. De Solla Price, "The Water Clock and the Tower of Winds" *AJA* 72.4 (1968): 345–55 and plates 111–118.

64 Drawnel, *The Aramaic Astronomical Book*, 214–223, 316–341, 341–352. VanderKam, *1 Enoch 2*, 353–354, 472–481.

65 Nickelsburg and VanderKam, *1 Enoch*, 104–6., Drawnel, *Aramaic Astronomical Book of Enoch*, 4Q210 1 ii.

66 These include, Virgil. *Georgics*. Bk 4. 297 (four winds); Vitruvius. *On Architecture*, Bk 1, ch. 6 (24 winds); Strabo, *Geography* Bk 1, ch. 2, 21.

67 Seneca, *Natural Questions* (trans. Hine; Chicago: Chicago University Press, 2010), 73–86. Online, translation by John Clarke (1910) from the Internet Archive: *Naturales Quaestiones: Physical Science in the Time of Nero*. Cited December 5, 2012, http://naturalesquaestiones.blogspot.co.uk/2009/08/book-v-tr-john-clarke.html.

of the heavens." (Seneca, *Nat Quest*, 5.17.1).[68] Hine does not attribute this belief to the Stoics amongst whom Seneca was prominent but leaves the interpretation open.[69] Seneca assigns different, palpable, meteorological qualities—gentle (sunset at the summer solstice), or harsh (sunset at midwinter)—to the named winds (disputing some assignations) that blow from different geographical directions (Seneca, *Nat Quest* 5.16).

Drawnel regards the Aramaic Enoch rose of winds as having "its origin in the Babylonian cultural milieu and being related to Babylonian celestial divination." He rejects the proposition put forward by Neugebauer that the source of the 12 winds in *1 En.* 76 is based on Hellenistic and Roman schemes;[70] Neugebauer states that this was a historical evolution from an eight-point rose to a twelve-point arrangement.[71] Drawnel argues that the conception of the four quarters of the sky in *4QAstronomical Enoch*^{c} (4Q210 frag 1, col. ii lines 2a, 14) agrees with Babylonian cosmology and he points out that P.V. Neugebauer and Weidner had adduced that the four cardinal directions/ winds in cuneiform sources included the sub-divisions.[72] He further suggests that the features of the winds in MUL APIN, which are related to ominous events, bear comparison with the description of the winds in 4Q210.[73]

However, there is no reason to rule out a culturally interactive connection between 4Q210 and the Greco-Roman tradition of 12 winds while also taking on board the inclusion of possible ominous meteorological predictions in the Aramaic text (4Q210 frag 1, col. ii lines 13–14 = *1 En.* 76.13). The details of the extant 12 different directions of the winds divided into three winds per quarter explicitly coincide with the Greek and Latin traditions, whereas cuneiform sources accentuate only the four cardinal winds. An underlying theme of the four winds as servants of the divine will is evident in the biblical tradition.[74]

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68 Seneca, *Naturales Quaestiones* (trans. Clarke), online, op. cit.

69 Seneca, *Natural Questions* (trans. Hine), xiii–xiv.

70 Drawnel, *The Aramaic Astronomical Book*, 341. Ref: O. Neugebauer, "The 'Astronomical' Chapters," 405 in M. Black, *The Book of Enoch or 1 Enoch* (Leiden: Brill, 1985).

71 Neugebauer, *The 'Astronomical' Chapters*, 24.

72 Drawnel, *The Aramaic Astronomical Book*, 341, citing P.V. Neugebauer and E.F. Weidner, "Die Himmelsrichtungen bei den Babyloniern," *AfO* 7 (1932): 269–271. Drawnel's transcription, comments and translation, *The Aramaic Astronomical Book*, 218–220, reconstruction, comments and translation, 221–223.

73 Drawnel, *The Aramaic Astronomical Book*, 341.

74 Dan 7:2, 8:8, 11:4; Ezek 37:9; Jer 49:36; Zec 2:6; and Sir 43:6b–21; they correspond to the four compass points, Gen 28:14, Num 35:5, 1 Kgs 7:25, 1 Chr 9:24, 2 Chr 4:4, Ps 107:3, Ezek 48:10, 16, 17, Zec 14:4. See also E.G. Hirsch and I. Benzinger, "Winds" in the *Jewish*

The biblical four winds each have a consistent, vaguely anthropomorphic, meteorological character;[75] furthermore, a narrative of 12 gates, three divisions within four main sections, is a repeated theme in the Hebrew Bible and New Testament,[76] although there is no biblical tradition that the four winds emanate from 12 'gates.'

The ambiguous reference by Seneca that there are those who align the 12 divisions of the heavens with the 12 winds presupposes that this mythology was known in Greek society; however, the cultural and geographical origin of the idea is left obscure. Evidence is now put forward that the 'Enoch Zodiac' is attested in inscriptional Greco-Roman stone sundials, some of which include a wind rose. The Hellenistic interest in the relationship between the signs of the zodiac and the seasonal daylight lengths, defined by the sun, not the moon, is attested in Vitruvius, *Ten Books on Architecture*, Book 9, Chapter 2, section 4 and Chapter 3.[77] I have discussed the relationship between the signs of the zodiac, the 'gates' and the seasonal daylight lengths in *1 En.* 72 elsewhere, since this scheme is not attested in the fragments of the Aramaic Astronomical Book (4Q208–4Q211).[78]

4.4.2 *Globe Dial, Prosymna, Greece*

One of the earliest 'Enoch Zodiac' sundials is a second century B.C.E., white marble globe from ancient Prosymna, in the Peloponnese. The dial was found by Carl Blegen in ancient Prosymna in the Argolid and published in further detail in the Ph.D dissertation of Sharon Gibbs.[79] According to Blegen, the date is about 125–100 B.C.E. and a later dedicatory inscription was added in

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Encyclopedia (1906), online. Cited December 4, 2012, http://www.jewishencyclopedia.com/articles/14940-winds.

75 East: Gen 41:6; 23, 27, Exod 10:13, Jer 18:17, Ezek 17:10, 19, 12, 27:6, Hos 12:1, Jonah 4:8, Hab 1:9; West: Exod 10:19; South: Eccl 1:6, Job 37:17, Lk, 12:55, Act 27:13; North: Pro 25:33, Song 4:16, Eccl 1:6.

76 Ezek 48:30–34 (three gates in the north, east, south, and west thus, 12 gates); Rev 21:13 (three gates in the east, north, south and west, thus, 12 gates).

77 Vitruvius, *Ten Books on Architecture* (trans. M.H. Morgan; Cambridge, MA: Harvard University Press, 1914), 275–281. Project Gutenberg ebook no. 20239. Accessed 5 January 2014. Online: www.gutenberg.org . *Ten Books*, 9.2, line 4: "I will next explain how the sun, passing through a different sign each month, causes the days and hours to increase and diminish in length."

78 H.R. Jacobus, "Greco-Roman zodiac sundials and their links with a Qumran zodiac calendar," *Mediterranean Archaeology and Archaeometry* (forthcoming 2014).

79 Gibbs, *Greek and Roman Sundials*, 27–30; 376–377, pl. 62, 378 (Gibbs cat. no. 7002G); Blegen, "Prosymna: remains of a Post-Mycenaean Date," 443–444, fig. 13.

FIGURE 4.4.2 *The Prosymna globe dial.*

the second century C.E.[80] The late second century B.C.E. is within the range of the carbon-dating of 4Q208. Gibbs suggests that the dial may be part of the celestial globe tradition begun by Thales of Miletus (late seventh century B.C.E.) and continued by Eudoxus (fourth century B.C.E.), according to Cicero.[81] Recently, Schaldach and Feustel published a detailed scientific paper on the Prosymna globe, also giving its "inception" date as 100 B.C.E. and its consecration in the Temple of Hera in Prosymna to the second century C.E. They describe it as "one of the most amazing scientific objects that has survived from antiquity."[82]

The Virgo–Aries arrangement is distributed on either side of the meridian line on the upper south face (see Figure 4.4.2). The letters from the names of the signs are written in-between 13 hour lines which extend vertically between the summer solstice signs at the top, and the winter solstice signs at the bottom, and seven horizontal day curves.[83] It is one of several types of zodiac dials in

80 Blegen, "Prosymna: Remains of a Post-Mycenaean Date," 444.

81 Gibbs, *Greek and Roman Sundials*, 30, and n. 13, citing Cicero, *On the Republic* 1.14 (Keyes, LCL), 21–27.

82 Karlheinz Schaldach and O. Feustel, "The Globe Dial of Prosymna," *BBS Bulletin* 25.iii (2013): 6–12 (esp. 6). I wish to thank the anonymous peer reviewer of my article, "Greco-Roman zodiac sundials and their links with a Qumran zodiac calendar," for this reference.

83 Gibbs, *Greek and Roman Sundials*, 27–30.

which the arrangement of the signs of the zodiac appear in a sequential order, either beginning at the summer solstice or the winter solstice. The dial represents the celestial sphere from a geocentric perspective: the sun's long shadow when rising due east at the vernal equinox would extend to *Krios* (Aries). The circles containing the signs of the solstices at the top (Cancer and Gemini) and bottom (Sagittarius and Capricorn) of the globe have a very thin space.

The grid widens proportionally giving the greater space to those signs: Virgo–Aries; Libra–Pisces in the centre of the globe on either side of the meridian. The inscriptions, some abbreviated, are written in proportionately sized letters according to the space on the grid of lines. There are a series of 13 shallow holes nine of which are marked with a numeral-letter.[84] The letters from the names of the signs are written in-between 13 hour lines which cross each of the holes including the meridian, between the summer solstice signs at the top, and the winter solstice signs at the bottom, and seven circular day curves, including the central equinoctial line. The order and arrangement of the Greek signs of the zodiac on either side of the meridian, from the top (Cancer-Gemini), to the bottom (Sagittarius–Capricorn) are given in Table 4.4.2a. (The inscription of Cancer straddles the meridian.) I have added the corresponding 'Enoch Zodiac' gate numbers in the far right column:

TABLE 4.4.2a *The zodiac sign order with proportional lettering (and translations) on the Prosymna globe. The corresponding gate numbers (far right column) are additional*

(Cancer)	(Gemini)	(*Gate 6*)
Καρκίν	ΟσΔίδυμο(ι)	
(Leo)	(Taur) [us]	(*Gate 5*)
Λέω ν	Ταυρ(ος)	
(Virgo)	(Aries)	(*Gate 4*)
Παρθέν[ος]	Κριός	
(Libra)	(Pisces)	(*Gate 3*)
ζυγος	Ιχφύε[ς]	
(Scorpi[o])	(Aquarius)	(*Gate 2*)
Σκόρπι[ος]	Υδπηχό[cς]	
(Sagittarius)	(Capricorn)	(*Gate 1*)
Τοξότες	Αιγόκε (ρως)	

84 Blegen, "Prosymna: Remains of a Post-Mycenaean Date," 444.

Below, Table 4.4.2b, transcribes and translates the lettering on the globe dial (see Figure 4.4.2) to indicate the way that the signs of the zodiac are spelled out spatially in the grid on either side of the meridian line. Taurus, Virgo, Pisces, Scorpio, Aquarius and Capricorn are abbreviated for length and there is an empty space on either side of the *omega* in Leo.

TABLE 4.4.2b *Prosymna globe showing the spacing of the letters of the zodiac signs*

Cancer	Gemini
KA PK IN	OΣ Δ IΔ Y M OI
L e o	T a u r[us]
Λ E Ω N	T AY P
V i r g [o]	A r i e s
Π AP Θ E N	K P IOΣ
L i b r a	P i s c e[s]
Z Y Γ O Σ	I X Φ YE
S c o rpi[o]	Aqua r i[us]
Σ K O P ΠI	YΔP H XO
Sagittarius	Capri[corn]
ΤΟΞΟΤΗΣ	Αιγο

The globe conforms to an 'Enoch Zodiac' angled from north to south, with Aries (Gate 4; Month 1), the spring equinox on the eastern side, the side where the sun rises, as described in *1 En.* 72: 4–10 (see Figure 4.1, or Figure 3.1.2 in the previous chapter).

Since the instument represents the celestial sphere from the perspective of the earth designed from a specific latitude, the long shadow of the sun when rising due east at the vernal equinox would fall on Aries, Gate 4.

The Prosymna globe has been designed with Cancer and Gemini, the summer solstice, inscribed in the top circle position, however, in a similar, concave, hemispherical dial from Rome (Section 4.4.3) the order is reversed. The arrangements, nonetheless, support the hypothesis that the Qumran 'Enoch Zodiac' employs this Greco-Roman zodiac scheme.

The arrangement of the holes and Greek letter numbering is similar to that of a sphere dial in Macerata, Italy, studied by Carusi and Baldini.[85] They suggest that the Macerata globe dial is earlier than the Prosymna globe and that the votive inscription on the latter would suggest that these instruments were kept in a temple and presided over by priests. The Prosymna globe is currently in the store room of the Archaeological Museum of Nafplion. (When I saw the dial it was on the floor by a pillar amongst boxes so it was not possible to see the whole object). The inscription was not visible to me in the globe's current position. Schaldach and Feustel translate it as, "The priestess of the goddess Hera, Thalia, has ordained me the herald of the sunny hours, for the mortals."[86]

4.4.3 *Hemispherical Dial, Rome*

The white marble hemispherical dial from Rome (housed in the Vatican Museum)[87] is finely inscribed with the Greek month names and the corresponding names of the signs of the zodiac in an abbreviated form. The letters are incised between seven horizontal circular day curves (that mark the sun's entrance to each sign of the zodiac) and 11 vertical hour lines (see Figure 4.4.3); the original position of the gnomon is uncertain.[88] Gibbs suggests that the gnomon may have been mounted at the bottom of the dial as suggested by S. Piale, or in the top edge of the now broken area.[89]

Like the sphere from ancient Prosymna, the Vatican hemispherical dial is of public display quality. The letters of the names of the months and signs are interspersed between the day curves and hour lines and are of different sizes, according to the spaces. The design is not dissimilar in that respect to the Prosymna globe except that the 'gates' are in reverse order to the Prosymna dial, running from the winter months at the top, to the summer. Gibbs does not date this instrument (See Figure 4.4.3).

The names of the solstitial months and signs are inscribed within very thin parallel circles at the top and bottom of the dial intersected by the hour lines. The names of the other months and zodiac signs appear in progressively increasing larger grid areas. The names of the months and their corresponding

85 A. Carusi and D. Baldini, "Il globo di Matelica," *L'Astronomia* 92 (1989): 30–38. I am grateful to Dionysios Kriaris for this reference.

86 Schaldach and Feustel, "The Globe Dial of Prosymna," 7.

87 Galleria dei Candelabri, no. 11 90 2439; Gibbs, *Greek and Roman Sundials*, 183–187, pl. 15, 183 (Gibbs cat no. 1068G).

88 Transcription, Gibbs, *Greek and Roman Sundials*, 183.

89 Gibbs, *Greek and Roman Sundials*, 183, citing S. Piale, *Memorie Enciclopediche Romane sulle belle arti*, vol. 5, 1805, 102–109 (drawings).

FIGURE 4.4.3 *The Roman hemispherical dial* (*Courtesy of the German Archaeological Institute, Rome*).

signs have been composed in alternating columns, in a chiastic data-based arrangement on either side of the meridian line in a A1 B2 B1 A2 sequence where B represents the zodiac signs and A the month names. The superscript numeral indicates that the months are mirroring their zodiac signs on the other side of the meridian line. The proportional lettering of each sign and month[90] translated with the gate numbers (in the far left hand column, added by the author) are outlined below (Table 4.4.3a). The abbreviations in the Greek epigraphy itself are indicated by the brackets.

The greatest grid space is filled by the four equinoctial months and zodiac signs.[91] January–Sagittarius and Capricorn–December (Gate 1) are in the top row. The second row is: February–Scorpio and Aquarius–November (Gate 2); row three is March–Libra and Pisces–October (Gate 3); row four is: April–Virgo and Aries–September (Gate 4) row five: May–Leo and Taurus–August (Gate 5); and June–Cancer and Gemini–July (Gate 6) are inscribed in the lowest, sixth row.

90 Gibbs, *Greek and Roman Sundials*, 183.

91 Vitruvius, *Ten Books On Architecture* (trans. Rowland), 115; Evans, *History and Practice*, 139–140.

TABLE 4.4.3a *The zodiac sign and month arrangement on the Roman hemispherical dial in six rows*

(*Gate 1*)	January	Sag(ittarius)	Cap(ricorn)	December
(*Gate 2*)	February	Sco(rpio)	Aquarius	November
(*Gate 3*)	March	Lib(ra)	Pis(ces)	October
(*Gate 4*)	April	Vir(go)	Ari(es)	September
(*Gate 5*)	May	Leo	Taur(us)	August
(*Gate 6*)	June	Can(cer)	Gem(ini)	July

Below, Table 4.4.3b gives an approximate sense of the spacing of the Greek epigraphy based on a visual examination of Figure 4.4.3 and Gibb's transcription (above), in order to make the photograph of the dial easier to read. The missing letters in the abbreviated Greek zodiac signs are indicated by brackets in the translations of those signs, and damaged Greek letters from the month names are indicated by square brackets.

TABLE 4.4.3b *An approximation of the arrangement of the lettering and the design of the Roman hemispherical dial*

January	Sagitt(arius)	Cap(ricorn)	December
IAN OY API OC	TOC	AIΓ	ΔEK EMB IOC
February	Sco(rpio)	Aqu(arius)	November
ΦEB PA PI O C	C K O	ΨΔ P	N OEMBPIO [C]
March	Lib(ra)	Pis(ces)	October
[M]A PT I O C	Z Y Γ	I X Θ	O KTΩBPI [OC]
April	Vir(go)	Ari(es)	September
A Π PI Λ I OC	Π A P Θ	KPE I	C E Π T E M B[POIC]
May	Leo	Taur(us)	August
[MA]I O C	Λ E O N	T AYP	A Y ΓO [YCTOC]
June	Canc(er)	Gem(ini)	July
[IOYF]IOC	KAPKI[NOC]	ΔIΔYM	I[OYΛIOC]

The abbreviated zodiac names and the pairing of the signs conform to the "Enoch Zodiac," running from the winter solstice (Gate 1), to the summer solstice (Gate 6). A daylight triangle has its apex centred on noon at the winter solstice; the top of the triangle touches the meridian line at the central point between

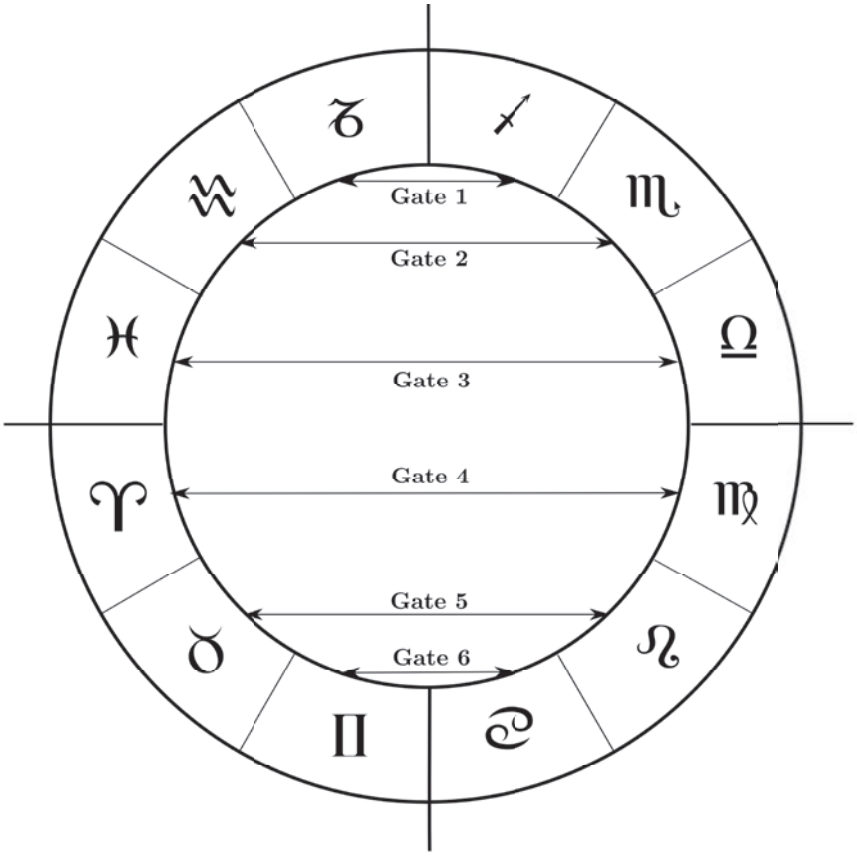

FIGURE 4.4.3a *The 'Enoch Zodiac' arranged from Gate 1 to Gate 6 in chronological order: the arrangement of the Roman hemispherical dial.* (*Key to signs: Aries* ♈; *Taurus* ♉; *Gemini* ♊; *Cancer* ♋; *Leo* ♌; *Virgo* ♍; *Libra* ♎; *Scorpio* ♏; *Sagittarius* ♐; *Capricorn* ♑; *Aquarius* ♒; *Pisces* ♓).

"Sagittarius" and "Capricorn," (inscribed in the top row) and widens out to the sixth row at "Cancer" and "Gemini." It represents the increase in daylight hours from the winter solstice to the summer solstice.[92] The lines of the daylight triangle intersect the equinoctial curves at the location of Libra-Pisces and April-Virgo, Aries-September, and the solstices.

The elliptical circle that touches the point where the daylight triangle meets the lower Libra-Pisces curve is the *menaeus*, which Vitruvius states

92 Gibbs, *Greek and Roman Sundials*, 183.

represents "the circuit of the monthly cycle."[93] Sidoli explains that the *menaeus* circle indicates that the sun is in a zodiac sign for a month, and that it moves about a degree a day along the ecliptic.[94] The meridian runs vertically through the *menaeus* to the right of which an empty column between the summer and winter solstitial zodiac signs separates the zodiac sign pairs. Figure 4.4.3a shows the 'Enoch Zodiac' arranged with the winter solstice at the top, so that the 'gates' are in chronological sequence from Gate 1, as they appear in the Roman hemispherical dial.

4.4.4 *Horizontal Plane Dial, Pompeii*[95]

This horizontal plane dial (drawing only) has the abbreviated names of the signs of the zodiac in Greek inscribed at the edges between the day curves. From the diagram, it appears to be more practical than beautiful. The shape of the dial is like a double axe-head, a two-dimensional form known as a *horologium pelecinon*, from *pelekinon* (Greek for axe), see Figure 4.4.4.[96]

The pairing of the signs on either side of the edges of the double-axe head, in-between the seven horizontal day curves conforms to the 'Enoch Zodiac,' with the summer solstice signs of Gate 6, at the top and the winter solstice signs of Gate 1, at the bottom. Both areas are proportionally much thinner. There are 11 hour lines and an extended meridian; in addition to the abbreviated zodiac signs; abbreviations for the Tropic of Cancer (top) and the Tropic of Capricorn (bottom) are written on either side of the central, vertical meridian line. The hole for the gnomon is indicated at the top centre and the equinoxes are inscribed in an abbreviated form on either side of the central horizontal axis.[97] The *terminus ad quem* is 79 C.E. (as for all artefacts from Pompeii).

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93 Gibbs, *Greek and Roman Sundials*, 183; Vitruvius, *Ten Books On Architecture* 9.7.6 (trans. Rowland), 116.

94 N. Sidoli, "Heron's Dioptra 35 and Analemma Methods: An Astronomical Determination of the Distance between Two Cities," *Centaurus* 47 (2005): 239. "The name of the menaeus circle indicates that in practice the solar longitude was likely modelled under the rough assumption that the sun was simply in a given 'month,' that is in a given sign of the zodiac. More precisely, one may assume that the longitudinal displacement of the sun is about a degree a day."

95 Gibbs, *Greek and Roman Sundials*, 331 (Gibbs cat. no. 4007); G. Fiorelli, "Di un orologio solare in marmo," *Giornale degli Scavi di Pompei* 3 (1865): 14–16.

96 Reproduced from Fiorelli, "Di un orologio solare," 14. For an explanation of the *pelekinon*, see also D. Mintz, "Time-keeping in the ancient world: sundials." n.p. Cited 27 August 2014. Online: http://www-history.mcs.st-and.ac.uk/HistTopics/Sundials.html.

97 Tropic of Cancer: ΤΡΟΠ (ὲ) ΘΕΡ (ινὴ); Tropic of Capricorn: ΤΡΟΠ (ὴ) ΧΕΙΜ (ερινὴ); meridian: ΜΕΣΗ (μ) ΒΡΙΑ: equator (equinox): ΙΣΗ ΜΕΡ (ινὸς) transcribed by Fiorelli, 16, 14. For an explanation of the sun's journey in an ancient sundial, see R. Hannah and

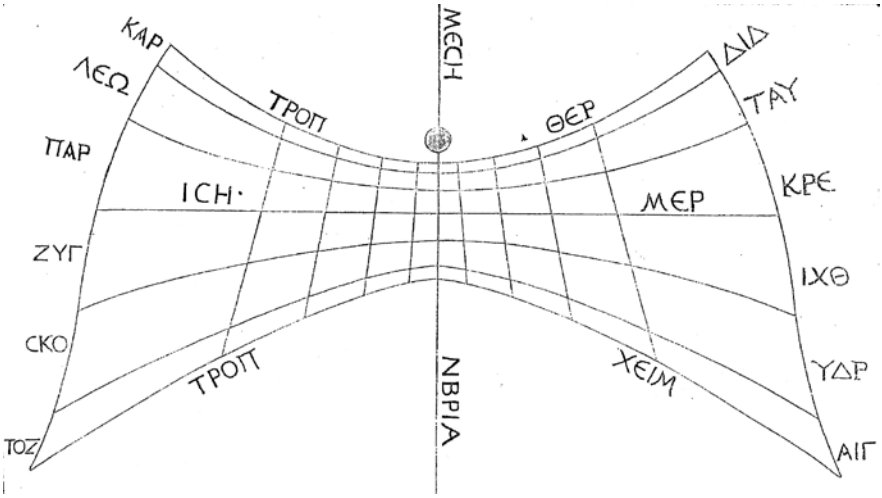

FIGURE 4.4.4 *Drawing by G. Fiorelli (1865) of the zodiac plane dial from Pompeii.*

TABLE 4.4.4 *The zodiacal order of the horizontal plane dial from Pompeii*[98]

Cancer	Gemini	(*Gate 6*)
ΚΑΡ (χῖνος)	ΔΙΔ (ύμοι)	
Leo	Taurus	(*Gate 5*)
ΛΈΩ(ν)	ΤΑΎ (ρος)	
Virgo	Aries	(*Gate 4*)
ΠΑΡ (θένος)	ΚΡ(Ε) (ιὸς)	
Libra	Pisces	(*Gate 3*)
ΖΥΓ (ὸς)	ʽΙΧΘ (ύες)	
Scorpio	Aquarius	(*Gate 2*)
CKO (ρπίος)	ʽΥΔΡ (οχόος)	
Sagittarius	Capricorn	(*Gate 1*)
ΤΟΞ (ότης)	ʼΑΙΓ (όχεπος)	

Table 4.4.4 (above) shows the distribution of the signs of the 'Enoch Zodiac' according to the horizontal plane dial from Pompeii (the 'gate' order is the

G. Magli, "The Role of the Sun in the Pantheon's Design and Meaning," *Numen* 58, 4 (2011): 486–513 (esp. 489–494).

98 The transcriptions with abbreviations and translations are published by Fiorelli, "Di un orologio solare," 16, and Gibbs, *Greek and Roman Sundials*, 331.

same as the Prosymna globe, above, with Gate 6, the summer solstice at the top). Following Fiorelli, the abbreviated Greek zodiac names have been written in capital letters as they appear in the inscriptions. The missing letters from the shortened form are written in lower case, and parentheses have been added to avoid confusion.

4.4.5 *Plane Dial from the Mausoleum of Augustus, Rome*[99]

The right side of the broken horizontal plane dial showing the remains of a double-axe head shape, the *pelekinon*, reveals that the Latin inscription probably employs a variant of the 'Enoch Zodiac.' The abbreviation for the summer solstice, winter solstice (on the central edges of the centre-right of the double axe-head), the spring equinox and three zodiac signs (on the right hand side) were extant. The present location is unknown. See fig. 4.4.5. for the surviving inscriptions from a drawing of the dial published in 1883. The square brackets indicate the missing letters, due to abbreviation, not, apparently,

[SOLST]ITALI[S] (summer solstice)

SOLST]ITALI[S]

G[EMINI]

TAVR[US]

(spring equinox) AEQ[UINOCTIALIS] · VERN[ALIS]

ARIES

(No inscription)

(No inscription)

[BRUM] AL [IS] (winter solstice)

FIGURE 4.4.5 *The order of the zodiac signs on the right side of the dial found in the Mausoleum of Augustus based on the 1883 drawing of the dial.*

for reasons of space. The drawing appears to indicate that there are uninscribed zodiac signs.

It appears from the original drawing of the sundial that there is a space above Gemini for Cancer and that the equinox has been placed between Aries and Taurus (rather than Aries and Pisces). If so, the summer solstice has been situated between Cancer and Leo (rather than between Cancer and

99 Gibbs, *Greek and Roman Sundials*, 333 (Gibbs cat. no. 4010), cited from *Atti della Reale Accademia dei Lincei* 11 (1883): 127 (drawing).

Gemini) and the winter solstice would be between Capricorn and Aquarius (rather than between Sagittarius and Capricorn). Gibbs does not suggest where the gnomon might have been placed. The gap between Taurus and Aries is wider than that between Gemini and Taurus with the vernal equinox inscribed midway between these two signs. See Table 4.4.5 for my proposed reconstruction of the arrangement of the signs of the zodiac on the unbroken dial.

TABLE 4.4.5 *Proposed reconstruction of the distribution of the zodiac signs on the dial found in the Mausoleum of Augustus*

	Summer	*solstice*	
(Gate 5)	Leo	Cancer	(Gate 6)
(Gate 4)	Virgo	Gemini	(Gate 6)
(Gate 3)	Libra	Taurus	(Gate 5)
Autumn	*Equinox*	*Spring*	*equinox*
(Gate 2)	Scorpio	Aries	(Gate 4)
(Gate 1)	Sagittarius	Pisces	(Gate 3)
(Gate 1)	Capricorn	Aquarius	(Gate 2)
	Winter	*solstice*	

Taking into account the find-spot in the interpretation of this artefact, if the dial actually belonged to the Mausoleum, where it was discovered in February 1883,[100] it may be proposed that it was designed to commemorate the calendar year of Augustus's death (on August 19, 14 C.E.). The spring equinox new moon (the conjunction) on 19 March, 14 C.E., the year Augustus died, was ten days behind the new moon of the following year, 9 March, 15 C.E.[101] In other words, it was an 'Easter late' year and may have followed intercalation. As shown in Chapter 1, it is possible to ascertain the different kinds of years from the date of the moon, for example, in this year, on March 19 the sun would have been in Aries, while the following year on the new moon of March 9, the sun would have been in Pisces.

100 Gibbs, *Greek and Roman Sundials*, 333.

101 See the US Navy's website on spring phenomena http://aa.usno.navy.mil/faq/docs/SpringPhenom.php.

The fact that two of the extant ancient zodiacal dials (see the Horologium-Solarium of Augustus, below) are associated with Augustus personally is consistent with the emperor's well documented interest in astrology: his emblem on coins was the goat-fish Capricorn and a star. It is not known if the reason for this symbol was because the moon was in that sign at his birth on 23 September, 63 B.C.E., or because the sun was in that sign at his conception, nine months earlier in January.[102]

According to the reproduced drawing of the dial, a circular wind rose was situated beneath the *horolgium pelecinon* bearing the extant Latin names of two winds, and there were defined lines indicating the compass points. Written upside down to indicate that the rose should be read in the round and inscribed in full, not abbreviated like the epigraphy on the dial, the winds are: AFRICVS and FAVONIVS. According to Vitruvius and Seneca, these are the names, respectively, of the West wind (the African wind) and the South-West wind.[103]

4.4.6 *The Horologium-Solarium of Augustus, Rome*

The length of the shadow-reach of the monumental zodiacal sundial, an Egyptian obelisk topped by a gilt globe and a gnomon, installed by Augustus on the Campus Martius in Rome in 9 B.C.E., is one of the most hotly contested archaeological hypotheses in Roman archaeology at present. In 1976, Edmund Buchner discovered bronze Greek letters inlaid in paving from the zodiac signs 'Virgo–Aries and Leo–Taurus' on either side of a meridian line, also inlaid bronze, in his excavations beneath a house in a built up area of the city in the Via Campo Marzio number 48, as he had predicted. According to his thesis, based on a description by Pliny (*N.H* 36.72–73), the pavement of the zodiacal instrument on the Campus Martius encompassed a large topographical area that included the Altar of Peace, the *Ara Pacis*, and the Mausoleum

102 Suetonius, *Life of Augustus* 94.12 (Rolfe, LCL [vol. 1]); Barton, *Ancient Astrology*, 39–41; M. Beard et al., *Religions of Rome* (Cambridge: CUP, 1998), 189; Barton, "Augustus and Capricorn" *JRS* 85 (1995): 33–51, on the astrological discussion with regards to Augustus and the moon, see 38–48; T. Barton, *Power and Knowledge: Astrology, Physiognomics and Medicine Under the Roman Empire* (Ann Arbor: The University of Michigan Press, 1994), 40–47; McEwen, *Vitruvius*, 245–246; Manilius, *Astronomica* (Goold, LCL), Introduction, xii.

103 Vitruvius, *Ten Books On Architecture* Bk 1, Ch. 6 (trans. Rowland); Seneca, *Natural Questions*, Bk 5, Ch. 16 (trans. Hine), 73–86. Online, translation by John Clarke (1910) from the Internet Archive. Cited December 5, 2012, http://naturalesquaestiones.blogspot.co.uk/2009/08/book-v-tr-john-clarke.html.

of Augustus.[104] Pliny only described the meridian line, in fact, as a bronze rod and that the pavement extended for a distance approximate to the height of the obelisk. Pliny was also concerned to explain that the dial had been out of synchronisation with the calendar for thirty years either due to anomalies in heaven, or on earth, or because of local earth tremors.

Buchner had claimed that the Egyptian obelisk, re-created as a gnomon, was placed next to the summer solstice signs of Cancer-Gemini so that on the days of the equinoxes (Augustus' s official birthday was on September 23–24, close to the autumn equinox),[105] the sun's shadow fell into the western opening of the *Ara Pacis*. He also argued that the gnomon was aligned with the Mausoleum of Augustus. Buchner's proposal as to the siting of the obelisk, the breadth of the astronomical complex, and whether there were any other lines apart from the meridian became the subject of scholarly dispute almost immediately.

Rodríquez-Almeida claims that the markers for the city boundaries which were extended by Domitian infringed the circumference of Augustus's putative dial complex, and that therefore, it was unlikely that the complex was as immense as Buchner had claimed.[106] Schutz contends that the shadow from the gnomon would not reach the *Ara Pacis* and that the dial probably consisted of a single meridian line with the zodiac, rather than the more complicated reconstruction proposed by Buchner.[107] He adds that the sun enters the beginning of each sign—the zodiacal system used by Hipparchus, Geminos and later, Ptolemy, and not at 8° of each sign—the astronomical scheme expounded by Vitruvius, Varro, and Pliny.[108]

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104 Buchner, *Die Sonnenuhr des Augustus und Nachtrag*, 43, figs l3 and 14; Beck, *Cosmic Models*, 100, 104–105 (fig. 2, 102); See also the reconstruction, as stated above, according to Vitruvius by Howe, in Vitruvius, *Ten Books On Architecture* (trans. Rowland), 289, fig. 115; Rehak, *Imperium and Cosmos*, 81–83, C.E. Newlands, *Playing With Time: Ovid and the Fasti* (CSCP 55; Ithaca, NY: Cornell University Press, 1995), 23 nn. 61, 62. Strabo, *Geography* Bk 17.1.26 (Jones, LCL); Pliny, *NH* 36.72 (Eichholz, LCL). For a condensed bibliography of scholarship related to Buchner's thesis until 2007, see Heslin, "Augustus, Domitian and the So-called Horologium Augusti," 1, notes 1–5.

105 Rehak, *Imperium and Cosmos*, 71–74.

106 E. Rodríguez-Almeida, "Il Campo Marzio settentrionale: *solarium e pomerium*," *Rendiconti della Pontificia Accademia di Archeologia* 51–2 (1978–80): 195–212.

107 Cf. M. Schütz, "Zur Sonnenuhr des Augustus auf dem Marsfeld," *Gymnasium* 97 (1990): 432–457; Schütz, "The Horologium on the Campus Martius reconsidered," *JRA* 24 (2011): 78–86. Rehak, *Imperium and Cosmos*, 83–84; Barton, *Power and Knowledge*, 45–47.

108 Schütz, "The Horologium on the Campus Martius reconsidered," 78. See Neugebauer, *HAMA*, 593–600; in Babylonian astronomy, the solstices and equinoxes were normed at the 10th degree ("System A") or the 8th degree ("System B") of their signs (Neugebauer, *HAMA*,

Beck suggested that the inlaid zodiac signs were an addition in the latter half of the first century C.E.;[109] however, Barton stated, "the shape of the letters are consistent with Augustan origin."[110] More recently, Hannah has suggested that Hadrian's mausoleum is topographically connected with the Augustan astronomical scheme hypothesised by Buchner.[111]

Be that as it may, the 'Enoch Zodiac' arrangement of the dial, whether early, or mid to late first century C.E., is archeologically supported by the position of the inlaid bronze letters comprising the names of the zodiac signs *in situ*, in the basement of 48 Via Campo Marzio. The arrangement of the signs is not the subject of academic disagreement. See Table 4.4.6: the excavated Greek capital letters are written outside of the square brackets.[112] A dividing line separates the signs on the east from the signs on the west and the signs themselves are separated by bronze dividers.[113] According to Buchner, the meridian would have been laid to the right of the signs, and there were another two columns of month names corresponding to their respective zodiac signs.[114]

The arrangement of signs according to Buchner would mean that the zodiac began in Gate 1, the same ideal scheme as the Roman hemispherical dial (in sub-section 4.4.3). To summarise, the artefacts surveyed above show that the arrangement of the signs of the zodiac in *1 En 72* appear in Greco-Roman

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594); Neugebauer states that according to Columella (*De re rust.* 11.2.94), Hipparchus defined the winter solstice as occurring on December 17 (that is, 0° Capricorn) and the Chaldeans placed it on December 24 (that is, 8° Capricorn); he also notes that according to an inscription, the "Fasti Venusii," two decades after 15 B.C.E. the entry of the sun in Cancer occurs on June 19, and the summer solstice on June 26: "This is obviously the calendaric equivalence for the sun's travel between the first degree of Cancer and the solstice at Cancer 8°," *HAMA*, 595–596 n. 18. He stated that the continued use of the Babylonian norm of "System B" is evidenced in the first five centuries C.E. Vitruvius norms the equinoxes and solstices at 8° Aries, Cancer, Libra and Capricorn, *On Architecture*, 9:3.8. Geminos states that the signs begin at the first degree of Aries in contrast to the Chaldeans who begin the solstices and signs in the 8th degree, in *Introduction to the Phenomena*, 1:1–16 (trans. Evans and Berggren), 114–115. Evans, *History and Practice*, 213–214.

109 Beck stresses that Domitian (81–96 C.E.) rebuilt the excavated area and whether he changed, or restored, the grid is a moot point, "Cosmic Models," 10.

110 Barton, "Augustus and Capricorn," 45.

111 Hannah, "The role of the sun in the Pantheon," 486–513; see also Hannah, "The Horologium of Augustus as a sundial," *JRA* 24 (2011): 41–49.

112 Buchner, *Die Sonnenuhr des Augustus und Nachtrag*, figs 2 (p. 360, *Nachtrag*, 64), 5 (p. 366, *Nachtrag*, 70), 6 (p. 367, *Nachtrag*, 71), plates, 1, 4, 5, 129, 134–137, 140–141, *Nachtrag*, pp. 71, 96–99, 102–103, 107, 110–111.

113 For example, Schütz, "The Horologium on the Campus Martius reconsidered," 1.

114 Buchner, *Die Sonnenuhr*, fig. 6, 367, *Nachtrag*, 71, and plates, see notes above.

TABLE 4.4.6 *The arrangement of zodiac signs to the left of the meridian line in the so-called Horologium-Solarium of Augustus according to Buchner's reconstruction based on the excavated Greek capital letters* (*Aries-Virgo, Taurus-Leo*)

Capricorn	Sagittarius
Aquarius	Scorpio
Pisces	Libra
Aries	Virgo
[K P I]O E	Π A P Θ[E N O E]
Taurus	Leo
T A Y [P O E]	[Λ E] Ω N
Gemini	Cancer

sundials, as well as in the Aramaic Astronomical Book. This comparative exercise had an unintended consequence that of enabling a suggestion for the variant arrangement of the 'Enoch Zodiac' found on the dial of the Mausoleum of Augustus. It was suggested that the dial had been adapted to reflect the position of new moon at the spring equinox in the calendrical year that Augustus died, in light of the scholarly discourse that Augustus had an interest in the moon, for astrological reasons. It is also possible that if the 'gates' are converted to solar months and back again to solar zodiac signs in the sundials a 'sundial month' might begin from about the 21st day of a civil month.

4.4.7 *Ptolemaic Ivory Sundial, Tanis, Egypt*

Evans and Marée reconstructed the arrangement of the zodiac signs on the late Ptolemaic miniature ivory sundial from Tanis, in the British Museum (inventory number EA 68475).[115] Although the pieces are incomplete, the restoration from the extant parts shows a scheme which does not conform to the concept of the 'Enoch Zodiac.' Instead of Sagittarius–Capricorn sited at the winter solstice and Gemini–Cancer at the summer solstice points, Capricorn and Cancer alone (without Sagittarius and Gemini, respectively) are situated at the top and bottom of a zodiac 'tree' and the other months are in pairs equidistant from those signs (See Table 4.4.7).[116]

115 Evans and Marée, "A Miniature Ivory Sundial," 5. See also N.E. Scott, "An Egyptian Sundial," *Bulletin of the Metropolitan Museum of Art* 30.4 (1935): 88–89, for a description of Roman Egyptian sundials in museum collections (the zodiac is not mentioned in any of these).

116 Manilius, *Astronomica* 1.631–683 (Goold, LCL).

The zodiac sign-pairs from Sagittarius to Gemini are positioned along the seven horizontal day curves on either side of the meridian. The arrangement does not concur with the arrangement of the zodiac in any of the zodiacal dials in the Gibbs catalogue.

TABLE 4.4.7 *Reconstruction of the zodiac sign pairs by Evans and Marée on the miniature ivory sundial*

Capricorn	
Aquarius	Sagittarius
Pisces	Scorpio
Aries	Libra
Taurus	Virgo
Gemini	Leo
Cancer	

As noted above, this arrangement, is in accordance with the "*Tetrabiblos* I.15 scheme," and it also agrees with the zodiacal paradigm in BM 36822+BM 37022, dated to Artaxerxes II, c. 400 B.C.E.[117] In this case, the zodiac tree on the Tanis sundial is in reverse order to the Persian-period tablet from Babylon.

When aligned correctly, the undercut front face would be illuminated by the sun from the first day of the autumn equinox until the first day of the spring equinox only.[118] Evans and Marée's description of how this remarkable instrument functioned bears repeating because it is so fascinating:

> Since, when the dial is properly orientated, the undercut front face lies in the plane of the celestial equator, the sun will never shine on this face during the spring or summer. The undercut face first becomes illuminated on the day of autumnal equinox. During fall and winter, by contrast, the sun shines on all the undercut face all day long. The face ceases to be illuminated on the day of the spring equinox. Thus is clear that IEHMEPIA ("equinox") labelled the undercut face and called attention to the fact that the illumination of this face served as an equinox indicator.[119]

117 Aaboe and Sachs, "Two Lunar Texts," 3–11; Neugebauer, *HAMA*, 709.

118 Evans and Marée, "A Miniature Ivory Sundial," 4.

119 Evans and Marée, "A Miniature Ivory Sundial," 4.

4.4.8 *The Scaiphe Dial, or Roofed-Spherical Dial from Roman Carthage*

This important dial and ancient *objet d'art* in The Louvre, Paris, is a concave half-sphere, in the shape of a luxury Roman drinking vessel carved out of crystallised beige marble, decorated with leaves and acorn motifs externally.[120] Dated to the first or second century C.E., it is designed so that the aperture in the bottom of bowl, which serves as the gnomon, should be tilted to allow the rays of the sun to enter the dial.[121] Although found at Carthage, it was not made for that latitude.[122] The date lines comprise seven declination curves for the dates of the sun's entry into the zodiac signs. There are 11 hour curves without figures. It is a '*Tetrabiblos* 1.15' scheme, not an 'Enoch Zodiac.'

The signs of the zodiac are inscribed between the seven date lines; the Julian Roman calendar months are translated into Greek[123] with the corresponding months, beginning on the days that the sun enters the zodiac signs, according to Savoie and Lehoucq.[124] These are the 24th and 25th of the months (except February, which is a 28-day month, not a 30 or 31-day month). It is possible that the dates on the dial coincided with 8° of each zodiac sign, according to the Babylonian "System B."[125]

The zodiac signs are apparently arranged in the same pattern as the miniature ivory sundial from Ptolemaic Tanis (above), in reverse: beginning at the summer solstice at the "eye," the gnomon, and ending at the winter solstice. The dates in Greek with Greek abbreviations are translations from Latin, and the solar zodiacal months begin eight days from the Kalends of each month.[126] The distribution of the signs in the zodiacal "tree" is outlined in Table 4.4.8 below.

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120 Louvre catalogue entry with images and description, and bibliography online (accessed 9 January 2013): http://www.louvre.fr/en/oeuvre-notices/roofed-spherical-sundial; Paul Gagnaire, "Le scaphé de Carthage (Cadran solaire trouvé à Carthage. Au Louvre M.N.E. 1178)" 1–41, Louvre report and images, undated pdf {post- Savoie and Lehoucq (2001)} http://www.inrp.fr/Acces/clea/cahiers-clairaut/CLEA_CahiersClairaut_134_ScaphedeCarthage.pdf.

121 Gibbs, *Greek and Roman Sundials*, 23–27; Evans, "The Dialer's Art," 280–281.

122 Savoie and Lehoucq, "Un cadran solaire," 25 (photo, 26). Carthage is at lat. 37° N, the dial is orientated to lat. 41° N, closer to Rome.

123 Savoie and Lehoucq, "Un cadran solaire," 31–32. See Gagnaire, "Le scaphé de Carthage," appendixes, pls. 1–11 and photographs.

124 Savoie and Lehoucq, "Un cadran solaire," 31–32.

125 See note on Babylonian "System B" under the "Horologium-Solarium of Augustus."

126 Gagnaire, "Le scaphé de Carthage," 19–20.

TABLE 4.4.8 *The zodiac arrangement in the scaife dial from Carthage*

Cancer	
Gemini	Leo
Taurus	Virgo
Aries	Libra
Pisces	Scorpio
Aquarius	Sagittarius
Capricorn	

The order is the same as that of BM 36822+BM 37022.[127]

4.4.9 *Vitruvius's "Winter Clock"*

The theoretical application of how Vitruvius's 'Winter Clock' (*On Architecture*, Chapter 9, Book 8) which has a zodiac wheel with a diagonal arrangement of the signs has not to my knowledge been demonstrated practically.[128] The 'Winter Clock' hydraulic machine had 365 "dots" on its rim, marked at equal intervals. The zodiac signs begin at 8° Cancer at the top,[129] Capricorn at the bottom, Libra to the right and Aries to an observer's left.[130] (Reflecting south, north, east, west respectively, mirroring the heavens).

In the 'Winter Clock,' the flow of water mimics the length of the daylight hours at the equinoxes and solstices: forceful in the winter, slowing down by the time it reaches Cancer, then picking up speed again. Below is an extract to show that the zodiac was very much a part of scientific thought in the wider society in the early first century B.C.E.

> 12. Because the rim of the larger drum will have images of the celestial signs, it must be motionless. At the top it should have the sign of Cancer, directly opposite the bottom sign of Capricorn, to the right of the

127 Aaboe and Sachs, "Two Lunar Texts," 3–11; Neugebauer, *HAMA*, 709.

128 Vitruvius, *Ten Books On Architecture*, Bk 8, Chap. 9 (trans. Rowland), 117–118; illustration, T.N. Howe, fig. 117, p. 291.

129 See note on Babylonian "System B" and the sun's entry at 8° of the zodiac signs under the "Horologium-Solarium of Augustus."

130 This arrangement of zodiac signs is a reverse of the ideal horoscope format which has Aries in the east on the horoscope or ascendant. It is found on the synagogue zodiac mosaic of Beth Alpha, see (for example the image), R. Hachili, *Ancient Jewish Art and Archaeology* (Leiden: Brill, 1988), pl. 73, or section 4.1 above.

> observer that of Libra, to the left the sign of Aries, and the remaining expanse between them should be portrayed as the signs are seen in the heavens. 13. Therefore, when the sun is in Capricorn, the little pointer of the smaller wheel, daily touching individual dots of Capricorn in the parts of the larger drum, and having the forceful weight of the running water at a vertical angle, quickly thrusts it out through the hole in the small wheel and into the reservoir, which takes it up. . . . When with daily rotation, the pointer on the smaller wheel advances into the dots of Aquarius [the sign following Capricorn, anti-clockwise if Cancer is at the top], the outlet . . . is slower to send it jetting out. . . . 14. As it ascends, stepwise, the dots of Aquarius and Pisces [the sign following Aquarius], the hole in the small wheel, in touching the eighth degree of Aries, presents the hours appropriate to the equinox because of the moderately spurting water . . . [and so on][131]

It is unlikely that the 'Enoch Zodiac' and the 'roundel' arrangement of signs were in conflict; more probably, they were alternative metrological systems, or served different functions.[132]

4.4.10 *Later Zodiacal Sundials*

The 'Enoch Zodiac' system is found on many important, public sundials dating from the late medieval period, such as the Prague Astronomical Clock, as well as in dials from the 18th and 19th centuries.[133] It is here suggested that horologists in the later periods ingeniously integrated ancient astrological practices into their engineering.

The Astronomical Clock, in Prague Old Town Square, in the Czech Republic (see Figure 4.4.10), has the 'Enoch Zodiac' in the smaller, inner circle, the zodiac ring. The size of the rising zodiac signs are in proportion to the hours of their daylight: thus, the signs Virgo to Aries (right, at the time the photo was taken) are lengthening, Libra to Pisces (left) are shortening on either side of the solstices. The zodiacal inner ring is illustrative of Manilius's description of the variable rising times of the zodiac signs.[134]

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131 Vitruvius, *Ten Books On Architecture*, 9.8.12–15 (trans. Rowland). See Fig. 117. 'Water Clocks: Winter Clocks', Vitruvius , *op. cit.*, 9.8.8, 291, by T.N. Howe.

132 See also Chapter 5. *Literary sources: Vitruvius.*

133 René R.J. Rohr, *Sundials: History, Theory and Practice* (trans. Gabriel Godin; New York: Dover Publications, 1996): description and images of zodiac sundials 107–108, 121, pls. 9, 11, 13, 16, 19.

134 Manilius, *Astronomica* 3.410–482 (Goold, LCL). See also §4.3 *The Sundial in Hellenistic Astrology.*

FIGURE 4.4.10 *The Astronomical Clock, Prague.*[135]

The position of the sun in the sky and zodiac, and the time in different traditions is represented by the golden image of the Sun and the golden hand, and the moon's position in the zodiac is represented by the Moon pointer, which is silvered and shows the lunar phase.[136] The order of the signs rising should be read anti-clockwise from the left (east), and the sun and moon's movements, clockwise. Thus, in Figure 4.4.10, the sun is in the early degrees of Cancer (late June, early July), the moon is in Libra (a waxing quarter moon). The time according to the position of the Sun and golden hand is about 4.30pm (the Roman numerals on the blue background represent local Prague time during the day). Sunrise, the first hour, signified by ORTVS on a pale blue background in the east, is in Scorpio, the sign of the Horoscope, or ascendant.

135 Prague Astronomical Clock. Photo by jay8085. Open access online License Creative Commons by 2.0. http://www.pragjesu.info/prague-astronomical-clock-l.htm#foot_second_plane. Accessed 16 January 2013.

136 See also the §5.4.1. *Antikythera Mechanism*.

The '*Tetrabiblos* 1.15' scheme appears to be reproduced in the miniature ivory diptych sundials manufactured in Europe, mainly in Nuremburg, from the sixteenth to eighteenth centuries. They have a similar, if not identical zodiac-tree pattern to the ivory sundial from Tanis, Ptolemaic Egypt.[137] The details of the longevity of the ancient sundial schemes are not the subject of this study; however, their re-appearance in the medieval and early modern period is noted.

4.5 Summary and Conclusion

There is no doubt that the growth of zodiac sundials in different forms was an important element of applied Hellenistic science in the late second century to the first century C.E. and later. It is of interest that *1 En.* 72:2–34 reflects the 'Enoch Zodiac' scheme found in certain kinds of dials in which the signs of the zodiac are used to measure seasonal daylight lengths, or hours of sunshine. It is not suggested that the luni-solar synchronistic calendar of 4Q208–4Q209 was a template for sundials, but that the 'gates' in the 'Enoch Zodiac' represented the zodiac signs and that these were explicitly used in the Hellenistic world. Therefore, the Aramaic zodiac calendars were integrated within the science of the time. The carbon-dating range of dates for 4Q208 may place that text within a contemporaneous period with the late second century B.C.E. Prosymna globe.

The existence of solar and lunar zodiac calendar schemes in the Greco-Roman and Hellenistic-Mesopotamian worlds shows that different cultures in the region shared scientific ideas within their own scholarly frameworks, while retaining their own 'language,' identities, and scientific historical backgrounds

137 See, for example, the National Maritime Museum collection online of ivory diptych sundials http://www.nmm.ac.uk/collections/search/listResults.cfm?category=Sundials&name=Diptych dial&sortby=t http://collections.rmg.co.uk/collections.html#!csearch;searchTerm=ivory_diptych_sundials; some other collections: British Museum; Museum of the History of Science, Oxford; Museum Boerhaave, Leiden and the Istituto et Museo di Storia della Scienza, Florence: http://www.mhs.ox.ac.uk/epact/handlist.php?FirstENumber=25985&RecordsAtATime=100&Pictures= retrieved August 27, 2014; see also Rohr, *Sundials*, pl. 28. The dials typically use several systems for measuring time, including Babylonian hours, that is, the principle that hours can vary in length. Variable hours were still common in Europe during this period, M.A. Vandyck, "A Unified and General Treatment of Solar Calendars and Sundials: II. Ancient Systems of Time-Reckoning," *Eur. J. Physics* 22 (2001): 315–323 (315).

and traditions.[138] Aside from the 'Enoch Zodiac,' there were other zodiac-sundial models, such as that described in *Tetrabiblos* 1.15.

The question is whether the 'Enoch Zodiac' originated in Greco-Roman sources or was transmitted from Babylonia or Jewish sources in Judea, or through such conduits. The synchronistic calendar of *4QAstronomical Enoch*$^{a-b}$ (4Q208–4Q209) functions by providing luni-solar calendar dates that are described in terms of the sun and the moon's position in the zodiac and the lunar phase. 4Q318 does not state the sun's position in the zodiac although it is implicit in its calendar and it does not have alternating 29 and 30-day months. Given that the synchronistic calendar of the Aramaic Astronomical Book itself consists of fixed, alternating 29 and 30-day months, which is attested in Greek calendrical science, not Babylonian, and there is the element of the sun which is not explicitly represented in the cuneiform luni-solar calendars, it may be suggested that the Aramaic Astronomical Book reflects Hellenistic influences, and that in contrast, aside from the evidence of the zodiac sign name of Virgo, as discussed in §1.5, 4Q318 does so to a much lesser extent.

The possible association between the Qumran Astronomical Book and Greek sundials was initially raised, and rejected, by Glessmer.[139] He and Albani, in a later paper, argued that de Vaux's catalogued object '1229: *disque de pierre*' discovered in 1954, in locus 45 at Qumran, was an elaborate astronomical measuring device.[140] The instrument, which was found in a cupboard in the Ècole Biblique, in Jerusalem, by the authors,[141] is small and portable. According to

138 Explored in non-zodiacal contexts in: Ben Dov, *Head of All Years*, 245–278, 282–287; M. Popović, "The Emergence of Aramaic and Hebrew Scholarly Texts: Transmission and Translation of Alien Wisdom," in *The Dead Sea Scrolls: Transmission and Tradition and Production of Texts* (ed. S. Metso, H. Najman and E. Schuller; Leiden: Brill, 2010), 81–114; M. Popović, "Networks of Scholars: The Transmission of Astronomical and Astrological Learning between Babylonians, Greeks and Jews," in *Ancient Jewish Sciences and the History of Knowledge in Second Temple Judaism* (ed. J. Ben-Dov and S.L. Sanders; New York: ISAW and New York University, 2014). Cited 4 February 2014. Online: http://dlib.nyu.edu/awdl/isaw/ancient-jewish-sciences/chapter7.xhtml.

139 U. Glessmer, "Horizontal Measuring in the Babylonian Astronomical Compendium MUL.APIN and in the Astronomical Book of Book of *1 En*," *Henoch* 18 (1996): 259–282 (at 281): "Perhaps those who transmitted this traditional Babylonian system [the MUL.APIN] did not use the newest scientific knowledge (and 'technology' of Hellenistic sundials) based on the zodiacal reference system intentionally."

140 U. Glessmer and M. Albani, "An Astronomical Measuring Instrument from Qumran," in *The Provo International Conference on the Dead Sea Scrolls* (ed. D.W. Parry and E. Ulrich; STDJ 30; Leiden: Brill, 1999), 407–442.

141 Glessmer and Albani, "An Astronomical Measuring Instrument from Qumran," 407–409.

Glessmer and Albani, the "measuring instrument" from Qumran . . . "could have been used to handle the discrepancy between 365.25 days and a calendar of 364 days."[142] Elsewhere, the authors calculate the markings on the hypothetical sundial as being related to "360 degrees of a full day."[143]

In the light of the zodiac dials shown in this chapter, contrary to Glessmer and Albani's thesis, it is doubtful that it would have been possible for the users of the stone disk from Qumran to have read the astronomical details of the zodiac and rising and setting times of constellations from the concentric circles and line-markings on the stone, as they describe, without any epigraphic indications to guide such detailed readings.[144] Sundials with unmarked lines indicating zodiacal months are known, such as the second century B.C.E. Chios meridian line and the late third century or early second century Ai Khanoum spherical dial, in Afghanistan;[145] however, these are designed for the latitudes concerned, rather than being portable and they are simpler than the Qumran object.

Other theories about the possible use of the *disque de pierre* have also suffered from the problem of over-reconstruction.[146] The practical application of the object has been contested; and some scholars dispute that it is a sundial,[147] although it has been accepted by the Shrine of the Book in Jerusalem as such.[148] In a study by Tavardon, it is argued that the stone instrument is a sundial built to the latitude of Qumran and that it supported a triangular gnomon.[149] This view has received some support with modifications from Dirk Couprie who suggests it is related to an Egyptian device that can function as a basic clock with a small gnomon and was possibly used as part of a pair.[150]

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142 Glessmer and Albani, "An Astronomical Measuring Instrument from Qumran," 442.

143 Glessmer and Albani, "An Astronomical Measuring Instrument from Qumran," 424.

144 Glessmer and Albani, "Astronomical Measuring Instrument," 427, 434–435, fig. 12.

145 See Hannah, *Time in Antiquity*, 81, 87–88.

146 B. Thiering, "The Qumran Sundial as an Odometer Using Fixed Lengths of Hours," *DSD* 9 (2002): 347–363; cf. G.M. Hollenback, "The Qumran Roundel: An Equatorial Sundial?" *DSD* 7 (2000): 123–129; G.M. Hollenback, "More on the Qumran Roundel as an Equatorial Sundial," *DSD* 11 (2004): 289–292.

147 So J. Ben-Dov, "The Qumran Dial: Artifact, Text and Context," in *Qumran und die Archäologie: Texte und Kontexte* (ed. J. Frey et al.; Tübingen: Mohr Siebeck, 2011), 211–238; Ben-Dov, *Head of All Years*, 189; Popović, *Reading the Human Body*, 161.

148 A. Roitman, *A Day at Qumran: The Dead Sea Sect and Its Scrolls* (Jerusalem: The Israel Museum, 1997), 19.

149 P. Tavardon, *Le Disque de Qumrân* (CRB 75; Pendé: J. Gabalda, 2010).

150 D.L. Couprie, "The Qumran Roundel and the *mrhyt*: A Comparative Approach," *DSD* 20 (2013): 264–306.

Since this chapter is concerned with zodiac sundials and the arrangement of the zodiac signs, the Qumran disc, so far as it has been explored, does not constitute convincing evidence for a hypothesis that the Greeks and Roman may have learned how to construct their impressive zodiac dials from Judean sources who may have been familiar with zodiacal Babylonian science. Conversely, there is no evidence that the zodiacal science of the Greek and Roman dials was practically applied in Judea since the so-called Qumran sundial bears no resemblance to any of them.

However, it cannot be ruled out that the 'Enoch Zodiac' of 4Q208–4Q211, not the supposed Qumran sundial, bears the hallmarks of Greek influence that may have come from Hellenistic Mesopotamia. The texts contain a cosmological typology, the 'gates,' in the synchronistic calendar of 4Q208–4Q209 and they appear to be reflected in Greco-Roman sundials although the concept of numerical substitution does not apply to classical Hellenistic Greek scientific thought. The cultural intersections of ideas, language, texts, archaeological artefacts and their geographical and intellectual contexts between Greece, Mesopotamia and Judea show how the zodiac was applied in many different, and developing, complex forms throughout the region in the third century B.C.E. to the second century C.E. In the next chapter I will look at zodiac calendars related to 4Q318 within early Jewish, Greco-Roman and Jewish-Hellenistic literary and scientific traditions.

CHAPTER 5

Zodiac Calendars in Hellenistic Texts and Artefacts

5.1 Introduction

This chapter investigates the possible origins of the dissemination of zodiacal calendars from Hellenistic society to Judea in the Second Temple period and the extent of their reach. All the Greco-Roman zodiacal material presented here is from primary sources.

In the first three sections, I analyze zodiacal cosmology in the writings of the first century C.E. Jewish Hellenistic historians Philo and Josephus, and in the work of Greco-Roman writers. In the final section, I consider zodiac calendars and zodiacal calendar systems from the late third century to the first century B.C.E. in Greco-Roman and Hellenistic scientific culture. The purpose of this investigation is to examine any possible intellectual affinities between 4Q318 and Classical Greek and Ptolemaic sources. This examination may identify other influences on *4QZodiac Calendar* and *4QBrontologion* from the wider society outside Judea, excluding sources from Seleucid Mesopotamia and Babylonia, which have been discussed in Chapters 1 and 2.

5.1.1 *Co-existence of Zodiac Calendars with Non-zodiacal Calendars*

This section provides a description of zodiac calendars that are attested in the Hellenistic world during the spread of the imperial, solar, Julian calendar. The Julian, or Roman, calendar was imposed in the Near East in the second half of the first century B.C.E., reaching Egypt initially in 30 B.C.E. and Asia in 9 B.C.E.[1] The Roman calendar was not adopted by Aramaic-speaking Jews in Roman-occupied Judea, who used the Babylonian calendar, or their form of it; although, outside of the periods of the First and Second Revolts (c. 68–73 C.E. and c.132–6 C.E.) when insurgent dating formulae were used in Jewish legal documents written in Hebrew and Aramaic in areas under rebel control, years

1 By the late first century B.C.E., the cities of Asia Minor, Northern Syria and Phoenicia had converted their luni-solar, Macedonian calendars to the solar calendar, Stern, "Jewish Calendar Reckoning," 111; Samuel, *Greek and Roman Chronology*, 155–8, 186–8; R. Hannah, *Greek and Roman Calendars*, 131–138; C. Bennett, *Alexandria and the Moon: An Investigation into the Lunar Macedonian Calendar of Ptolemaic Egypt* (Leuven: Peters, 2011), 127–8; Stern, *Calendars in Antiquity*, 225–227.

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were dated by the year of the Roman emperor.[2] It shall be shown that throughout this period of calendrical upheaval the zodiac calendar as an astronomical construct outside Judea in the wider Greek and Roman society remained stable, although it appears, disappears and reappears in variant forms.

The persistence of zodiac calendars is reflected in a simple pedagogical formula that is repeated in Philo's work and in other Classical literature. It is that the moon takes a month of 29.5 days to orbit the Earth and an average of two and a half days to travel through each sign; and that the sun takes a year to orbit the Earth, and a month of 30 days (the 360-day calendar) to traverse each zodiac sign. It is interesting that these astronomical concepts appeared with such frequency in literature during the period of extreme calendrical change throughout the region, when the calendar of Julius Caesar was incorrectly implemented and also after it was corrected.[3] It may suggest that calendrical multiplicity was the convention and considered the norm throughout the ancient Near East and Mediterranean. Different types of calendars had separate purposes, and, at the end of the first century B.C.E. to the early first century C.E. they could still co-exist and be used alongside each other by serving different, specific functions. Furthermore, the zodiac calendars are very easy to follow, possibly more so than the Julian calendar at the turn of the era (see Ovid, later in the chapter).

5.2 Zodiacal Cosmology in the Work of Philo

The Alexandrian philosopher, Philo (c.20 B.C.E.–50 C.E.), who is contemporary with the Dead Sea Scrolls, writes at length in several passages about the solar and lunar zodiacs separately and in terms of their relationship with each other. This section will suggest that Philo refers to more than one calendar and that these are reflected in his exegesis of biblical passages and in his explanation of biblical festivals.

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2 Aramaic documents found in Judea dated to the Roman emperor, using the apparent Babylonian calendar included one in the cave of Wadi Murabba'ât, dated the second year of the Emperor Nero (55 or 56 C.E.), J.T. Milik, "Mur 18. MurIOU ar," DJD 2, 104–9; and another dated 25th Tevet in the third year of Domitian (84 C.E.), in E. Eshel, H. Eshel and H. Misgav, "Jer 7. JerDateCrop ar," DJD 38, 55–61. Summarised in H.R. Jacobus, "Calendars from Jewish Documents in the Judean desert from the First Revolt to Bar Kokhba," *Henoch* 35 (2/2013), 273–289.

3 For the inception and reform of the Julian calendar, see Samuel, *Greek and Roman Chronology*, 155–67; B. Blackburn and L. Holford-Strevens, *The Oxford Companion to the Year*, 670–2.

Philo has inserted the simple astronomical rule about the integrated relationship between the solar and lunar zodiacs into the section on Joseph's dreams (Gen 37:7–9), in *Dreams* 2.112–13. He interprets Joseph's dream of the sheaves as a visual metaphor to explain how the lunar and solar zodiacs function.

> Well, the students of the upper world tell us that the Zodiac, the largest of the circles of heaven (τὸν ζῳδιακὸν κύκλον μέγιστον . . . οὐρανὸν, is formed into constellations out of twelve signs (δυοκαίδεκα), called *zodia* (ζῳδίων) or "creatures" from which it also takes its name. The sun and moon (ἥλιον δὲ καὶ σελήνην), they say, ever revolve along the circle (ζῳδίων) [*zodia*] and pass through each of the signs, though the two do not move at the same speed, but at unequal rates as measured in numbers, the sun taking thirty days (ἡμέραις τριάκοντα), and the moon about a twelfth (δωδεκατημορίῳ)[4] of that time, that is, two and half days (ἡμερῶν δυεῖν καὶ ἡμίσους). He, then, who saw that heaven-sent vision, dreamt that the eleven stars made him obeisance, thus classing himself as the twelfth (δωδέκατον) to complete the circle of the zodiac (ζῳδιακοῦ συμπλήρωσιν κύκλου).[5]

Philo refers to the lunar zodiac (*Spec. Laws* 2.142) in his explanation of the reasons for the celebration of the New Moon festival *noumenia* (νουμηνία) in the calendar of biblical feasts, (*Spec. Laws* 2.140–213).

> . . . the moon traverses the zodiac in a shorter fixed period than any other heavenly body. (. . . οὐρανὸν ἁπάντων ἐν ἐλάττονι προθεσμίαι σελήνη τὸν ζῳοφόρον περιπολεῖ). For it accomplishes that revolution in the span of a single month, and therefore, the conclusion of its circuit, when the moon ends its course at the starting point at which it began. . . .[6]

Stern observes that *Spec. Laws*. 2.142 cannot be taken literally because the moon does not return to the previous month's starting point at the beginning of the next month. In other words, Philo appears to have described a sidereal month—returning to the same starting point against the fixed stars—which is 27.32 days, whereas the synodic month, when the moon returns to the same

4 The dodekatemoria also refer to techniques in Hellenistic and Babylonian astrology involving the twelfths of the zodiac signs, discussed in Chapter 1.

5 Philo, *Dreams* 2. 112–13 (Colson and Whitaker, LCL, v. 10).

6 Philo, *Spec. Laws* 2. 142 (Colson and Whitaker, LCL).

lunar phase, is 29.53 days.[7] Philo also states that the New Moon marks the beginning of the month (*Spec. Laws* 2.140) and that it is defined as the lunar crescent lit by the sun after conjunction (*Spec. Laws* 2.141). Here, he clearly means the synodic month. The main point of interest from *Spec. Laws*. 2.142 is that the lunar zodiac was part of the scientific vocabulary at that time and that it may have had a special significance for the biblical festival calendar.[8]

Philo's commentary on Gen 1:14–17 includes a discourse about the stars, the sun and the moon for determining the calendar (*Creation* 55–61). Here, he appears to state that the astronomical year has 360 days, derived from 12 months all of which consist of 30 days:

> The heavenly bodies were created also to furnish measures of time: for it is by regular revolutions of sun, moon and the other bodies, that days and months and years were constituted . . . For out of one day came "one," out of two, "two," out of three, "three," out of a month "thirty" (καὶ ἐκ μηνὸς τὰ τριάκοντα), out of a year (καὶ ἐξ ἐνιαυτοῦ) the number equivalent to the days made up of twelve months (δώδεκα μηνῶν) . . .[9]

Elsewhere, Philo describes an awareness of calendrical diversity and solar and lunar calendars:

> (*QE* 1. Quest.1) [Exod 12:2]: But not all (peoples) treat the months and years alike, but some in one way and some in another. Some reckon by the sun, others by the moon . . .[10]

Marcus understood that calendrical plurality pertains to all nations ("all {peoples}"), and that therefore this was not an endogamous situation among Jews.[11] The theory that Philo knew of a calendrical scheme similar to that of 4Q318 may be supported by his clarification of the way that the solar and the lunar zodiacs work separately in relation to the calendar. Philo refers to the solar

7 Stern, *Calendar and Community*, 118. Stern adds: "It [the moon traversing the zodiac] is an astronomical notion that is not known to have been used as the basis of any lunar calendar month."

8 Cf. Philo, *Creation* 101 (Colson and Whitaker, LCL) in which he states that the moon takes 28 days to wax and wane from first to last crescent.

9 Philo, *Creation* 60. (Colson and Whitaker, LCL).

10 Philo, *QE* 1 (Marcus, LCL), 4–5.

11 Philo, *QE* 1 (Marcus, LCL), 5 *note* b.

zodiac while explaining the biblical rationale for Exod 12:2, that is, that the year begins at the spring equinox when the sun in Aries (*QE* 1.1):[12]

> For they call the Ram, the head of the zodiac (κεφαλὴν τοῦ ζῳοφόρον ... τὸν κριόν)[13] since in it the sun appears to produce the vernal equinox.[14]

In *Creation* 116, Philo again refers to the solar zodiac in terms of the equinoxes:

> The sun, too, the great lord of the day, bringing about two equinoxes each year, in Spring and Autumn, the Spring equinox in the constellation of the Ram (κριῷ) and Autumn equinox in that of the Scales (ζυγῷ,) ...[15]

Philo's exposition of calendrics and cosmology implies a separation between the solstices and equinoxes, which are solar, and the months, which are lunar. If Philo is reckoning the calendar with solar years and lunar months, he may be referring to a luni-solar calendar of some kind. If so, the sun and moon would be synchronized by the addition of an embolismic month to keep the festivals in their correct seasons. Stern observes that Philo does not make intercalation explicit;[16] however, it may be implicit in the reference to the seasons occurring at their proper time, as in *Moses* 2.121:

> ... and in unison with the harmony of All display their several powers (δυνάμεις) at fixed revolutions of time (ὡρισμέναις χρόνων περιόδοις) and at their proper seasons (προσήκουσι καιροῖς).[17]

In this context, if Philo were referring to a solar calendar, the "proper seasons" might be tautologous; the phrase might be more meaningful in a luni-solar calendar, which requires more frequent periodic corrections. Philo's theology

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12 Phil, *QE* 1, Question 1 (Marcus, LCL).

13 Philo, *QE* 1. Question 1 (Marcus, LCL), 2, note *g*.

14 Cf. Josephus. *Ant*. 3. 248, see next sub-section.

15 Philo, *Creation* 116 (Colson and Whitaker, LCL, v.1), 92–3. The reference also echoes that of Josephus, *Ant.* 3. 248. Cf. *Geminos's Introduction to the Phenomena*. 8.5–15 (Evans and Berggren, 176–7): "For the year is one thing by the Sun and another by the Moon. For the solar [year] comprises a circuit of the Sun around 12 signs, which is 365¼ days; while the lunar [year] comprises the time of 12 lunar months, which is 354 days." (8.5) ... "And, therefore, when the years are reckoned strictly by the Sun and the months and days by the Moon, the Greeks keep to the custom of sacrificing in the manner of the fathers ... " (8.15).

16 Stern, *Calendar and Community*, 54.

17 Philo, *Moses* 2.121 (Colson, LCL).

and cosmological view is expounded in great detail in his exegesis of Exod 28. He uses combined celestial and calendrical metaphors for the Temple's artefacts and the High Priest's accoutrements, particularly the breastplate,[18] and the menorah. As Fernandez Marcos has shown, this style of writing belongs to a tradition in which the vestments of the high priest represent the cosmos, and the high priest himself, a microcosmos. In *Moses* 2.124,[19] within a lengthy passage (*Moses* 2.122–126) Philo asserts that the 12 gems on the priestly breastplate represent the signs in the solar zodiac arranged to correspond to the four seasons of the solar year. In this pericope, Philo does not refer to months; the cosmological reference here concerns the sun, that is, the tropical year divided into seasons, solstices and equinoxes:

> (*Moses* 2:124): . . . . the [twelve] stones (δώδεκα λίθοι) at the breast, which are dissimilar in colour, and are distributed into four rows of threes, what else should they signify but the zodiac circle (ζῳδιακοῦ κύκλου)? For that circle, when divided into four parts, constitutes by three signs (ζῳδίων) in each case the seasons of the year—spring, summer, autumn, winter—those four, the transition in each of which (τροπὰς τέσσαρας, ὧν ἑκάστης) is determined by three signs (τρὶα ζῴδια), and made known to us by the revolutions of the sun (ἡλίου περιφοραῖς) . . .[20]

In a similar vein, in *Moses* 2.126, Philo compares the 12 stones on the High Priest's breastplate to the signs of the zodiac, emphasizing their different colours and individual influences on the elements, animals and plants.

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18 *QE* 2.107–23; *Spec. Laws* 1.84–97 and *Moses* 2.109–35. See Natalio Fernandez Marcos, "Rewritten Bible or *Imitatio*? The Vestments of the High Priest," in *Studies in the Hebrew Bible, Qumran, and the Septuagint. Presented to Eugene Ulrich* (eds. P.W. Flint, et al. SVT 101. Leiden: Brill, 2006), 321–336 (esp. 329–335).

19 Philo, *Moses* 2.124 (Colson, LCL).

20 Philo, *Moses* 2.124, (Colson, LCL v. 6); cf. the translation by Yonge includes the equinoxes and solstices, see: C.D. Yonge, *The Works of Philo* (Peabody, MA: Hendrickson, 2004), 501: ". . . For that also is divided into four parts, each consisting of three animals, by which divisions it makes up the seasons of the year, spring, summer, autumn and winter, distinguishing the four changes, the two solstices, and the two equinoxes, each of which has its limit of three signs of this zodiac, by the revolutions of the sun . . ." The reference to the "three signs" alludes to the system of zodiacal triplicities known in Mesopotamia (see zodiacal geography in: The *Gestirn Darstellungen Texts*, pp. 74–83). They are also attested in later Hellenistic astrology, Ptolemy, *Tetrabiblos* (Robbins, LCL), xxvi, 1.18 and II.3 (zodiacal geography).

> (Moses 2.126): It is an excellent and indeed splendid point that the twelve stones are of different colours and none of them like to any other. For each of the signs of the zodiac also produces its own particular colouring in the air and earth and water and their phases, and also in the different kinds of animals and plants.[21]

In *QE* 2, Questions, 76, 77,[22] with reference to the menorah in the Temple [Exod 25:31–40],[23] Philo relates the signs in the solar zodiac to the four seasons, again without mentioning the months.

> (Ques. 76) [on Exod 25:33]: At each season of the year the sun completes (its course) through three zodiacal signs (ζῳδίων)[24] which He has called "mixing bowls" . . . . For example the spring (consists of) Aries, Taurus, Gemini; and again, in the summer, Cancer, Leo, Virgo; and in the autumn, Libra, Scorpio, Sagittarius; and in the winter, Capricorn, Aquarius, Pisces. And He likens the form and nature of the zodiacal signs to those of a nut . . .
>
> (Ques. 77) [Exod 25:34–6]: Each branch constitutes one season of the year through three zodiacal signs (ζῳδίων),[25] as has been said [Ques.76, above], while the lampstand represents the seasons of the year, which are four.

In sum, Philo was familiar with both the lunar and solar zodiac and he distinguished between them appropriately when discussing months (the moon) and the year (the sun). It is also possible that Philo was referring to more than one calendar.

Philo discussed zodiacal calendars by assigning exegetical significance to them, as part of a divine cosmological scheme reflected in the Bible. He is contemporary with the Dead Scrolls and the dating of 4Q318, and his hermeneutics may reflect Alexandrian Jewish ideas. Some of his technical writing on his reinterpretation of Exod 28, as Ferdandez Marcos has shown, was fashionable

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21 Philo, *Moses* 2.124 (Colson LCL); cf. Weidner, *Gestirn Darstellungen*, in which the signs of the zodiac are assigned particular, stones, cities, temples, plants and trees (Chapter 1.3.2).

22 Philo, *QE* 2. (Marcus, LCL); Ralph Marcus, "The Armenian Translation of Philo's Quaestiones in Genesim et Exodum," *JBL* 19.1 (1930): 61–4.

23 Philo, *QE* 2, Questions 73 and 81 (Marcus, LCL), 122–131, correspond.

24 Philo, *QE* 2, (Marcus, LCL). Question 76, 125 note *c*.

25 Philo, *QE* 2, 127 n.*e*; the reference is to Exod 25, 34–36.

for that time. It would appear from Philo's exposition of cosmology and the calendar that he knew a zodiacal paradigm similar to *4QZodiac Calendar*. Furthermore, Philo suggests that biblical authors were aware of this calendar and that they explicated it with symbols and metaphors. If these theological concepts prevailed in Judean society, the zodiac calendar of 4Q318 need not have been regarded as Hellenistic in origin, but of biblical antiquity.

5.2.1 *Josephus's Familiarity with the Zodiac Calendar*

In ancient Jewish literature, the frequent analogies between the zodiac and the Tabernacle are unique to Philo and Josephus;[26] moreover, Josephus's references to the zodiac and the calendar are similar to those of Philo. Although Josephus (37 C.E.–C.100 C.E.) knew of Philo's representations to Caius, he does not refer specifically to his writings, nor cite him as a source.[27] Like Philo, Josephus is also contemporary with the Dead Sea Scrolls, albeit the later scrolls; by his own account, as a young man he learned about the Essenes.[28] This autobiographical statement,[29] taken together with his references to the zodiac and calendrical units, to be discussed, creates the possibility that Josephus may have been familiar with a zodiac calendar.

Josephus appears to refer to the solar zodiac, when he wrote that the date of the Pascal sacrifice in Nisan, the first month of the year, double-dated to the Macedonian month, Xanthicus/ Xandikos,[30] was "on the fourteenth day by lunar reckoning when the sun was in Aries (κριῷ)":

> Τῷ δὲ μηνὶ τῷ Ξανθικῷ, ὃς Νισὰν παρ' ἡμῖν καλεῖται καὶ τοῦ ἔτους ἐστὶν ἀρχή, τεσσαρεσκαι-δεκάτῃ κατὰ σελήνην έν κριῷ τοῦ ἡλίον καθεστῶτος . . .

26 J. Klawans, *Purity, Sacrifice, and the Temple* (Oxford: OUP, 2006), 125–128, he states that similar imagery reappears in the (ca, 11th century) Midrash Tadshe, in which 12 oxen (1 Kgs 7.25) represent the zodiac (Tadshe 2) and the Menorah, the seven planets (Tadshe 11), suggesting the transmission of earlier traditions.

27 Josephus, *Ant*. 18. 259–260 (Feldman, LCL).

28 Josephus, *Life* 2: 10–12 (Thackeray, LCL); Todd Beall, *Josephus' Description of the Essenes Illustrated by the Dead Sea Scrolls* (Cambridge: Cambridge University Press, 2004), 13, 34; K. Atkinson and J. Magness, "Josephus's Essenes and the Qumran Community," *JBL* 129:2 (2010): 317–342; S. Mason, *Flavius Josephus on the Pharisees: A Compositional-Critical Study* (Leiden: Brill, 2001), 343–345.

29 For a summary of some scholarship on the historicity of (*Life*. 10–12), see, Taylor, "Classical Sources on the Essenes," 178.

30 Samuel, *Greek and Roman Chronology*, 139–151: the Macedonian calendar was no longer luni-solar in the first century CE; Stern suggests that Josephus was drawing an equivalence with the Jewish months anachronistically, *Calendar and Community*, 37–8.

> In the month of Xanthicus, which with us is called Nisan and begins the year, on the fourteenth day by lunar reckoning, the sun being then in Aries, . . .[31]

Josephus's reference to the solar zodiac could pertain to a zodiac calendar that was used in Judean society, or he was using an astronomical frame of reference that would be familiar to a Roman audience. On balance, given Philo's frequent references to the zodiac and the calendar discussed above, it is possible that Josephus referred to Aries because this association existed in Second Temple Jewish tradition as well as in the wider society. It is interesting to note that the cross-dating of Passover to the position of the sun in a zodiac sign with the day of the lunar month is similar to this book's interpretation of the 'gates' in 4Q208–209.[32]

Like Philo, Josephus also uses the zodiac and the cosmos to assign calendrical and cosmological symbolism to the Tabernacle and the priestly vestments (Exod 28:2–43); although, Josephus appears to reverse Philo's symbolism in a game of literary rhetoric. Philo compares the arrangement of the stones of the high priest's breastplate to the solar zodiacal turning points of the seasons, and does not mention months;[33] in *Ant.* 3.186, Josephus uses the gems in the ephod to mirror the (lunar) months of year, which he equates with the 12 signs of the zodiac. He does not mention the solar year:

> Τήν τε δωδεκάδα τῶν λίθων εἴτε τοὺς μῆνάς τις θέλοι νοεῖν, εἴτε τὸν οὕτως ἀριθμὸν τῶν ἀστέρων, ὃν ζωδιακὸν κύκλον Ἕλληνες καλοῦσι, . . .
>
> As for the twelve stones, whether one would prefer to read in them the months or the constellations of like number, which the Greeks call the circle of the zodiac, . . .[34, 35]

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31 Josephus, *Ant.* 3.248 (Thackeray, LCL), 436–437. This is a probable reference to a tradition that Passover was celebrated after the vernal equinox, marked by the sun crossing into Aries (known in rabbinical Judaism as the Rule of the Equinox), see Stern, *Calendar and Community*, 54–55, n. 14.

32 See Chapter 3. Summary and conclusion.

33 Philo, *Moses* 2. 124–126.

34 Josephus, *Ant.* 3. 186 (Thackeray, LCL). Elsewhere, Josephus further emphasises that the Jewish calendar was lunar: *Ant.* 2.318; 3.240; 3.248; 4.78; 4.84, see, Stern, *Calendar and Community*, 22 n. 97, 35.

35 Loren L. Johns comments: "Josephus says that although the term zodiac (ζωδιακὸν) comes from the Greeks, the phenomenon was long known to the Hebrews. The recent manuscript discoveries at Qumran have further substantiated not only that the zodiac was known among conservative Jews of the first century, but also that there was an interest

Both Philo and Josephus refer to the 12 loaves on the table of the Tabernacle (Lev 24:6), but for Philo, the bread of the Presence represents the 12 tribes (*Heir.* 175) and may, therefore, have implicit calendrical-zodiacal significance by association.[36] For Josephus, the loaves overtly represent the calendar in two separate texts (*Ant.* 3.182a and *J.W.* 5.217b). In *Ant.* 182a Josephus divides the year into months, which are lunar, and does not mention the zodiac. In *J.W.* 5.217b, the loaves represent the circle of the zodiac and the year; no months are referenced. In both cases, the loaves are linked with the seven planets, which include the sun and moon and the five planets (Mercury, Venus, Mars, Saturn and Jupiter),

> *Ant.* 3.182a: Again, by placing upon the table the twelve loaves, he signifies that the year is divided into as many months μῆνας· [lunar]
>
> [*Ant.* 3.182b] By making the candelabrum to consist of seventy portions, he hinted at the ten degree provinces of the planets, and by the seven lamps thereon the course of the planets themselves, for such is their number.[37]
>
> *J.W.* 5.217a: The seven lamps (such being the number of branches from the lampstand) represented the planets;
>
> [*J.W.* 5.217b] . . . the loaves on the table, twelve in number, the circle of the Zodiac and the year [solar] οἱ δ᾽ ἐπὶ τῆς τραπέζης ἄρτοι δώδεκα τόν τε ζῳδιακὸν κύκλον κἀι τὸν ἐνιαυτόν;[38]

Josephus's reference to the alignment of the seven planets to the seven branches of the Menorah in *J.W.* 5.217a is similar to Philo's *QE* 1; Questions 75

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in astrology," in *The Lamb Christology of the Apocalypse of John: An Investigation into Its Origins and Rhetorical Force* (Tübingen: Mohr Sieback, 2003), 70. A similar view is taken by Luther H. Martin, "Use of *Heimarmene* in *Jewish Antiquities* XIII. 171–3," *Numen* 28.2 (1981): 127–137 (esp. 132).

36 "Observe also the loaves set forth upon the holy table, how the twelve are divided into equal parts and placed in sets of six each, as memorials of the twelve tribes . . . " Philo, *Heir.* 175, Colson and Whittacker, (LCL, v.4), 370–371. Cf. Philo, *Rewards* 65: ". . . twice six in number, the perfect number, the copy and likeness of the zodiac cycle, a source of increased welfare to things here below" (Colson, LCL, v.8, 350–353, and 353 note *a* gives a reference to *Spec. Laws* 2.178) where Philo refers to the zodiac as "the greatest of heavenly bodies").

37 Josephus, *Ant.* 3.182b (Thackeray, LCL), Books 1–3, 404–5, note *a*, an astrological technique is referred to in this pericope; however, the method is unclear, see also ibid., 403 note *c*.

38 Josephus, *J.W.* 5.217 (Thackeray, LCL).

and 78. Josephus could either have been directly influenced by Philo's text, or they shared the same source. Similarly, *Ant.* 3.182b contains the motifs of the Menorah and the seven planets. Interestingly, the two pericopae, if read together, form one parallel text with an ABBA chiastic structure.

The explicit calendrical significance to the 12 loaves, in *J.W.* 5.217b and *Ant.* 3.182a, is unique to Josephus.[39] Josephus appears to follow Philo in attributing the engraved stones on the High Priest's shoulders (Exod 28:9–12) as symbols of the sun and moon.[40] It is also possible that the association derived from a common Jewish oral tradition. Josephus seems to be engaging with the work of Philo and creating literary continuities, both with the Alexandrian philosopher's work and his own. There appears to be a familiarity with the concept of a zodiac calendar, although unlike Philo, Josephus does not give the astronomical formula of how it works, nor does he describe the lunar micro-zodiac calendar. The absence of great depth or breadth may suggest that Josephus was not as interested as Philo in the zodiac calendar scheme, or that it was not in use as much as it had been during the time of Philo. Nonetheless, it may be argued that Josephus, like Philo, also applied a cosmological interpretation to the zodiac. Furthermore, the calendar, the zodiac and the planets had biblical and theological significance.

5.3 Literary Sources: Vitruvius, Geminos, Strabo, Ovid, Manilius

In contrast to the poetic and exegetical exposition of the zodiac calendar by Philo and Josephus, Greco-Roman scientists and writers were interested in its function and its material application in a non-theological sense. It will be shown that in the period that 4Q318 was copied, zodiacal science was fashionable in the Hellenistic world. This section will turn to the work of Greco-Roman writers in the arts and sciences and to the widespread popularity of the zodiac as an astronomical concept. The repetition of the formula relating to the different velocities of the sun and moon through the zodiac is noticeable.

Vitruvius (c.80–70 B.C.E.–c.15 C.E.), the Roman, writer, architect and engineer, explained the solar and lunar zodiac in his magnum opus, *On Architecture*,[41]

39 Cf. Philo, *Heir* 175b, the calendar-zodiacal associations of the loaves with the 12 tribes are possibly implied by association with the number 12.

40 Josephus *Ant.* 3.185; Philo. *Moses* 2.122; cf. *Heir* 176. (Colson and Whitaker, LCL, v.4) 370–371.

41 *Vitruvius: Ten Books on Architecture* (trans. I.D. Rowland; ed. I.D. Rowland et al.; Cambridge: CUP, 1999); Vitruvius. *On Architecture, Books 1–10* (Granger, LCL).

which he presented to Augustus in the mid-20s B.C.E.[42] His Book 9 of the *Ten Books* concerns astronomy, weather prediction and the scientific innovations of the time: sundials and water clocks. The science and astronomy is zodiacal and the engineering inventions are dominated by the zodiac,[43] although some of the schemes may be in the realm of fantastic, ancient science fiction.[44]

The first chapter of Book 9, 1.5–6 encapsulates the astronomical scheme paralleled in *4QZodiac Calendar*, very clearly.

> 1.5. These signs, therefore, are twelve in number and each individual sign occupies one-twelfth part of the firmament, and all of them are constantly rotated from east the west . . . The moon, traversing its circuit in a little more, by about an hour, than once every twenty-eighth day, completes its lunar month by returning to the sign in which it had first set out. 6. In the turning of a month, the sun, in its journeys, traverses the space of a single sign, that is, one-twelfth of the firmament. By travelling across the distance of twelve signs in twelve months, it completes the interval of the revolving year when it returns to the sign in which it began. In other words, that circuit which the moon runs thirteen times in twelve months, the sun measures out only once in the same number of months.[45]

Vitruvius's description of the relationship between the solar and lunar zodiac may be amongst the earliest literary uses of this formula. In this scheme, the moon traverses 13 schematic sidereal zodiac signs to make one synodic month, as do *4QZodiac Calendar* and the "Dodekatemoria scheme."

The first century B.C.E. Greek scientific writer, Geminos of Rhodes,[46] appeared to explain the solar zodiac calendar system in greater detail, high-

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42 Augustus ruled the Roman Empire from 30 B.C.E. to 14 C.E.

43 Book 9 is divided into 8 chapters thematically as follows 1: the zodiac and the planets; 2: phases of the moon explained; 3: the course of the sun though the 12 signs; 4: the northern constellations; 5: the southern constellations; 6: astrology and weather prognostications; 7: the analemma [a 2-dimensional astronomical scheme for designing sundials, which includes the zodiac] and its applications; 8: zodiacal designs for water-clocks.

44 The zodiac clock (Vitruvius, *On Arch.* 9.8.8–15) may not have been "much more than a pipe dream, for the difficulty of engineering . . . is very considerable and probably near the margin of Greek competence in science and technology.," Joseph V. Noble and Derek J. de Solla Price, "The Water Clock in the Tower of Winds," *AJA* 72.4 (1968): 345–356 (351–352). See Chapter Four, *Vitruvius's Winter Clock.*

45 Vitruvius, *On Architecture.* 9.1.3–6; Rowland et al., *Ten Books*, 109–110.

46 J. Evans and J.L. Berggren, *Geminos's Introduction to the Phenomena: A Translation and Study of a Hellenistic Survey of Astronomy* (Princeton: Princeton University Press, 2006), Introduction, 1, 15–22; The date of Geminos had been dated to the mid-1st century C.E.:

lighting the problem of the schematic 360-day solar zodiac calendar against the 365¼ day year:

> **I.7.** The Sun passes through the zodiac circle in a year . . . This time is 365¼ days: for in just so many days does the Sun pass by the 360 degrees, so that the Sun moves very nearly a degree in one day. **8.** However, a degree is one thing, and a day is another. For a degree is a certain distance, being 1/30th of a sign, while a day is a time period, being very nearly 1/30th of the monthly period. Moreover, the degree is 1/360th of the zodiac circle, while the day is very nearly 1/365¼ part of the annual period. All the signs are thirty degrees long, but not all are thirty days.
>
> *Geminos's Introduction to the Phenomena* [Isagoge](1. 7–8)[47]

The model described here is not the ideal 360-day zodiac calendar of the luni-solar micro-zodiac scheme. In fact, the moon is not mentioned. Geminos may be distinguishing the solar zodiac calendar scheme—days—from the zodiac used for astrological purposes only—degrees. Geminos ascribes the horoscopic elements of the zodiac to the "Chaldeans"[48] and gives an explanation of the aspects of the zodiac signs.[49] Elsewhere, his explanation of the sun's journey through the zodiac is related to the calendar in terms of the varying daylight lengths of the seasons and the relationship between the position of the sun in the zodiac and its rising and setting points on the horizon.[50]

Strabo (64 B.C.E.–25 C.E.) informs his readers in *Geography*, possibly written c.18–24 C.E.,[51] that unless they understood basic lessons in astronomy, including the obliquity of the zodiac, they should not read his book. He further claims that this knowledge belonged to elementary education at that time.[52] The point of interest is that Strabo's comments on the usefulness of astronomy for the study of geography lends support for the contention that the Aramaic zodiac calendar scheme of 4Q318 may have been part of the educational curriculum.

O. Neugebauer, *HAMA* (Berlin: Springer-Verlag, 1975), 579–81; F. Rochberg, "New Evidence for the History of Astrology," *JNES* 43:2 (1984), 123.

47 Evans and Berggren, *Geminos's Introduction to the Phenomena*, 114.

48 Evans and Berggren, *Geminos's Introduction to the Phenomena*, 2.5.

49 Evans and Berggren, *Geminos's Introduction to the Phenomena*, 2. 2–45.

50 Evans and Berggren, *Geminos's Introduction to the Phenomena*, 1. 34–41; 7.1–37. Cf. *1 En.* 72:2–36.

51 D. Dueck, *Strabo of Amasia: A Greek Man of Letters in Augustan Rome* (London: Routledge, 2000), 146–151.

52 Strabo, *Geography*. 1.1.21 (Jones, LCL).

The Roman poet Ovid (43 B.C.E.–17 or 18 C.E.) refers to the solar and lunar zodiacs in a segment of his epic astronomical and calendrical poem, *Fasti*.[53] The work was written during the reign of Augustus, remaining unfinished as a result of the poet's exile in 8 C.E. It was revised in the years between the death of Augustus in 14 C.E. and Ovid's own death in c. 17 C.E.[54]

The poet imparts the history of Roman calendar reform, from the legendary past of Romulus, through to Julius Caesar (Ovid, *Fasti*. 3.99–166), recording that the pre-historical Roman calendar had 10 months.[55] Ovid describes the mathematical relationship between the sun and the moon and the zodiac succinctly:

> Who had then noticed . . . that the [zodiac] signs, which the brother travels through in a long year, the horses of the sister, traverse in a single month? The stars ran their courses free and unmarked throughout the year; yet everybody agreed that they were gods.[56]

Due to the fact that the Julian calendar is solar, one would have thought that there was little use for the lunar zodiac. Yet, Ovid provides evidence that both the solar and lunar zodiacs were known during this period, or, at least, in living memory. Interestingly, when Ovid describes the introduction of the solar calendar of Julius Caesar in 46 B.C.E. (Ovid, *Fasti*. 3.155–65) it is reported as hearsay, and he does not understand how it works,[57] perhaps because it was incorrectly implemented and confusing. After Julius Caesar's death in 44 B.C.E., the pontifices added the leap day every three years: fourth by inclusive counting in the Roman method of reckoning. The error was realised in 9 B.C.E. and gradually corrected by Augustus until 8 C.E.[58] The time-periods straddle Ovid's life-time and the composition of *Fasti*, yet Ovid is under the impression that Caesar's calendar was corrected every five years:

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53 I thank Jonathan Kirkpatrick for suggesting to me that I should read this work.

54 E. Gee, *Ovid, Aratus and Augustus: Astronomy in Ovid's Fasti* (Cambridge, CUP, 2000), 3.

55 The scholarly consensus is that the very early Roman calendar had 304 days, consisting of 10 months: April, June, Sextilis, September, November and December had 30 days, and March, May, Quintilis and October, 31 days (Samuel, *Greek and Roman Chronology*, 167–168; Hannah, *Greek and Roman Calendars*, 98–100). The Latin month names from Quintilis to December describe these months' numerical positions in the calendar in a year beginning in March (Ovid, *Fasti* 2:149–151).

56 *Ovid's Fasti*. 3.10–112 (Frazer, LCL), Frazer notes that Ovid is referring to: "Apollo and Diana, the sun and moon, and the signs of the zodiac," p. 128 note *c*.

57 Ovid's *Fasti*. 3.161–5 (Frazer, LCL) and 132 note *a*.

58 Blackburn and Holford-Strevens, *Oxford Companion to the Year*, 670–671. Feeney, *Caesar's Calendar*, 197–198.

> *Fasti* 3.161: He [Caesar] is said to have drawn up an exact table of the periods within which the sun returns to his proper signs. To three hundred and five days he added ten times six days and a fifth part of a whole day. That is the measure of the year. The single day compounded of the (five) parts is to be added to the lustre. (Frazer, LCL)

Ovid's misinterepretation begs the question of whether the incorrect, confusing version of the Julian calendar was in widespread use at the turn of the era, or whether other calendars were in use also. The "exact table of periods within which the sun returns to his proper signs" may suggest the correlations of solar months with zodiac signs; this idea was put forward with reference to 4Q208–209 in Chapter 3. If so, it implies that there was an alignment with the Julian calendar and the tropical zodiac signs within the solar calendar.

The Roman poet and astrologer Marcus Manilius (fl. early first century C.E.) wrote his epic astrological poem, *Astronomica* (c. 9–14 C.E.) during the reign of Augustus and Tiberius.[59] His use of the zodiac in his astronomical section is similar to the late Babylonian sidereal micro-zodiac attested in TCL 6.14 and the *Gestirn Darstellungen* tablets discussed in Chapter 1. Manilius explained that each sign of the zodiac is divided into 12 segments of 2½° each.[60] These dodecatemorias have an astrological purpose and meaning when occupied by the moon.[61] The order of each dodecatemory begins with the sign of its zodiacal constellation and ends with the 12th sign from the first. Therefore, the moon would orbit 360° before moving onto the next zodiacal constellation:

> Within their own domain the constellations keep the first division for themselves, the next is bestowed upon the sign following, and the remaining signs according to their place in the sequence are allotted successive divisions, and the last assignment is made to the farthest sign away. Thus each sign occupies in every constellation two and half of its degrees, making a total of thirty degrees exacted from the whole zodiac.[62]

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59 K. Volk, *Manilius and his Intellectual Background* (Oxford: Oxford University Press, 2009), 137–162.

60 Manilius, *Astronomica*, 2.687–749 (Goold, LCL, introduction xii, li–liv). They are similar to the micro-zodiac discussed by Sachs in Babylonian Horoscopes, *JCS* 6 (1952): 72–73; Hunger and Pingree, *Astral Sciences*, 29; Neugebauer and Sachs, "The 'Dodekatemoria' in Babylonian Astrology," *AfO* 16 (1952–53): 65–66.

61 A. Bouché-Leclercq, *L'Astrologie Grecque* (Paris: 1899), 216 n. 3, 299 n. 1–304; Manilius, *Astronomica*, 2.687–74, esp. 2.726–737 (Goold, LCL).

62 Manilius, *Astron*: 2.716–721 (Goold, LCL).

This arrangement would not work with *4QZodiac Calendar* whereby the moon travels 390° from first crescent, to first crescent. If this astrological scheme were also a calendar, it would describe schematic sidereal months, not the synodic months. If so, it would represent a schematic zodiac calendar of 360 days that may not have functioned in practice as a calendar, since Manilius does not mention a method of correction, but as a template for a solar zodiacal model for astrological purposes.

5.3.1 *A Note on the Influence of Augustus*

Although this section concentrated on literary sources, it may be relevant to note that during the period that 4Q318 is dated, as discussed in the previous chapter, Augustus erected the so-called Horologium-Solarium, or a sundial, on the Campus Martius in Rome.[63] Its Egyptian obelisk, topped by a golden globe, served as a gnomon for a zodiacal plane sundial on the pavement and there may have been an alignment with the the Altar of Peace, the *Ara Pacis* on Augustus's official birthday, September 23, close to the autumn equinox.

Notwithstanding the scholarly dispute on this subject, the message was that Rome and its emperor represented a micro-cosmos. The zodiacal sundial monument and artefact are consistent with the emperor's interest in astrology and a zodiacal sundial was also found in the mausoleum of Augustus.[64] The emperor may have been an important influence for perpetuating the zodiac calendars during the establishment of the Julian solar calendar in Alexandria in 26/25 B.C.E. in the fifth year of his reign.

Writers such as Vitruvius, Strabo, Ovid and Manilius produced work relevant to this theme during his era. The cosmological zodiac calendar and the civil calendar, which was undergoing a long process of revision, may have coexisted, each one serving a different purpose: one for the human as a microcosmos, and the other to regulate humankind's life on earth.

5.4 Era Dionysios

Having discussed the zodiac calendar and astrological schemes reflected in Classical literary work, I shall now turn to ancient calendars that bear a similarity to *4QZodiac Calendar* in terms of their astronomical components and technical function. One of the most striking of these is a third century B.C.E.

63 See §4.4.6.

64 S. Gibbs, *Greek and Roman Sundials* (New Haven, Yale University Press, 1976), 333; see § 4.4.5.

Ptolemaic solar zodiac calendar known as the calendar of Era Dionysios. This calendar, which may be described as a solar version of the zodiac calendar from Qumran, is attested from just eight references to it in Ptolemy's *Almagest*[65] (mid-second century C.E.). It existed in Egypt (possibly in Alexandria)[66] and is recorded for eight dates over 45 years, spanning the first three generations of Ptolemaic kings. The month names were cognate with the corresponding solar signs of the zodiac and the day of the month coincided approximately with the zodiacal degree of the sun, for example: the date, Parthenon [Virgo] 10, Year 45 of Era Dionysios, corresponded with the zodiacal longitudinal position of the sun on that day, 10° Virgo.[67] (See Table 5.4a)

TABLE 5.4a *The Calendar of Era Dionysios with corresponding zodiac signs and months * Unattested months in parentheses*[68]

Dionysian months*	**Equivalent zodiac signs**	**Egyptian months (which drift)**
1. [Karkinon?]	Cancer	Thōth
2. Leonton	Leo	Phaōphi
3. Parthenon	Virgo	Hathyr
4. [Zygon? {Or Chelae?}]	Libra	Choiak
5. Skorpion	Scorpion	Typbi
6. [Toxoton?]	Sagittarius	Mecheir
7. Aigon	Capricorn	Phamenōth
8. Hydron	Aquarius	Pharmouthi
9. [Ikhthyon?]	Pisces	Pachōn
10. [Krion?]	Aries	Payni
11. Tauron	Taurus	Epeiph
12. Didymon	Gemini	Mesorē
		Epagomenai

65 G.J. Toomer, *Ptolemy's Almagest* (London: Duckworth, 1984), 13–14, 450, 451, 452, 464, 464, 502, 505 n. 67, 522 (*Almagest*: 9.7, 9.10, 10.9, 11.3).

66 The place is not attested in the Almagest but from an independent source: a 9th–10th century scholion on the *Almagest*, translated by Alexander Jones, "A Posy of *Almagest* Scholia," *Centaurus* 45 (2003): 70–71, (Scholion to *Almagest* 9.7, text 1).

67 Toomer, *Almagest*, 522.

68 Toomer, *Almagest*, 13–14; Jones, *Ptolemy's*, 288; Samuel, *Greek and Roman Chronology,* 50–52.

The structure may have corresponded to the Egyptian calendar of 360 days with five, or six epagomenal days (the precise structures of both calendars are a matter of scholarly discourse).[69] Unlike the Egyptian civil calendar, the months did not wander, but stayed in the same place.[70] The Dionysian calendar began on the summer solstice, June 26, 285 B.C.E., about five months before the start of the co-regency of Ptolemy II Philadelphus and his father Ptolemy I Soter, in 285 B.C.E.[71] The last Dionysian date recorded by Ptolemy was in 241 B.C.E., during the reign of Ptolemy III Euergetes (246–222 B.C.E.). This was just three years before the Canopus Decree (*OGIS* 56)[72] of 238 B.C.E., which failed to introduce a calendar of 365¼ days.[73]

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69 The civil Egyptian calendar consisted of 12 months of 30 days plus five epagomenal days; there were no leap years, which caused the months to drift. See R.A. Parker, *The Calendars of Ancient Egypt* (Chicago: The University of Chicago Press, 1950), 13–23; Blackburn and Holford-Strevens, *Oxford Companion to the Year*, 708–10. Alexander Jones outlines the unresolved scholarly dispute as to whether a sixth epagomenal day (366 days) was added to the Dionysian calendar every four years, in idem, "Ptolemy's Ancient Planetary Observations," *Annals of Science* 63:3 (2006): 255–290, at 285 n.47 and idem, "On Greek Stellar and Zodiacal Date-Reckoning," in *Calendars and Years* (ed. John M. Steele, Oxford: Oxbow, 2007), 150, 160–4 (esp. 163–4). According to Neugebauer, the lack of intercalation made the Egyptian calendar popular with Hellenistic astronomers (unlike the luni-solar calendar of the Babylonians, or of the Greeks which is believed to have been subject to local political tampering {cf. F. Dunn, "Tampering with the Calendar," *ZPE* 123 (1998): 213–223}), O. Neugebauer, *The Exact Sciences in Antiquity* (New York: Dover), 81.

70 Jones, "On Greek Stellar," 163.

71 Alexander Jones, "Ptolemy's," 285; B.L. van der Waerden, "Greek Astronomical Calendars III: The Calendar of Dionysios," *AHES*, 29.2 (1984): 125–130; the co-regency was possibly established on December 1, 285 B.C.E.; Ptolemy I died in 282 B.C.E.; see Nina Collins, *The Library of Alexandria and the Bible in Greek* (Leiden: Brill, 2000), 23–24.

72 W. Dittenberger, *Orientis Graeci Inscriptiones* (Supplementum Sylloges Inscriptorum Graecarum. 2 vols; Leipzig: S. Horzel, 1903, 1905), 1.91–110 (abbrev. OGIS).

73 R.A. Parker argues that, despite scholarly arguments, there is no evidence that a 366-day leap year ever existed in the Egyptian calendar itself, see, "The Calendars and Chronology," in *The Legacy of Egypt* (ed. J.R. Harris; Oxford: Clarendon Press, 1971), 19 n.1. but he states that in 238 B.C.E., Ptolemy III made a failed attempt to so reform the calendar with the Canopus Decree. See also Blackburn and Holford-Strevens, *Oxford Companion to the Year*, 709–10. The leap day at the end of every fourth year (366th day) was finally implemented in Year 5 of the reign of Augustus 26/5 B.C.E. (the Alexandrian calendar, implemented by Augustus, who became king of Egypt in 30 B.C.E.). See also, Jones, "Greek Stellar and Zodiacal Date Reckoning," 163–164.

All the Dionysian dates are double-dated by Ptolemy to the Egyptian calendar and Era Nabonassar.[74] In several instances, but not all, the date corresponds closely to the zodiac degree.[75] Where there is a discrepancy between the zodiacal date and the mean zodiacal longitude of the sun, it is a few days' difference of degrees. Jones, therefore, suggests that Ptolemy either did not have a detailed knowledge of the intricacies of the Dionysian calendar, or that the beginning of the calendar year was unclear.[76] Furthermore, he rejects the statements by the scholiasts that the dates and the degree of the sun's position in the zodiac were meant to coincide, although he accepts that Ptolemy himself may have understood that the Dionysian calendar so functioned.[77] In addition to the scholion cited in the note above (text 1), Jones also questions the accuracy of another scholiast:

> Dionysius named the twelve months, which had thirty days, by transference from the twelve zodiacal signs, and likewise (named) the days from the degrees at which the sun was approximately in mean motion . . . (Scholion to *Almagest* 11.3; text 2).[78]

In Jones's view, the Dionysian calendar included five and six epagomenal days in its count of the year and that its 365 and 366 days[79] were distributed among the months in a manner similar to the divisions in the parapegmata where the zodiac is present. In these Greek "star calendars," the solar zodiac

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74 The use of the reign of Nabonassar (747–734 B.C.E.) as an era for dating purposes is unique to Ptolemy (*Almagest*, III.7, see Toomer, op. cit., 168); Rochberg, *Heavenly Writing*, 146.

75 Other scholarship includes August Böckh, *Über die vierjähringen Sonnenkreise der Alten, vorzüglich den Eudoxischen* (Berlin: Reimer, 1863), 286–340; Jones, "Ptolemy's," 285 n. 47. Jones rejects the hypothesis that there was a leap day, in the calendar of Dionysius because Ptolemy's astronomical records do not match such a scheme, "On Greek Stellar," 164; Lehoux, *Astronomy, Weather, and Calendars*, 213–4; Neugebauer, *HAMA*, 1066–7. Neugebauer follows the mss. favouring Hydron 29, instead of Hydron 21—(no.4 in list) (Toomer, *Almagest*, 450 n. 58)—the reading which the other scholars accept; Samuel, *Greek and Roman Chronology*, 50–51, 50 n. 6; Samuel states that there were five epagomenal days in years 1, 2 and 4 (365-day years), and 6 in year 3 (366-day year), Toomer, *Almagest*, 14.

76 Jones, "Ptolemy's," 286–287, 288–289.

77 Jones, "Posy," 73.

78 Jones, "Posy," 73; "Greek Stellar and Zodiacal Date Reckoning," 160, 163.

79 Jones, "Ptolemy's," 289.

months vary from 29 to 32 days, with the longer months in the summer, so that the calendars comprise 365-day years.[80] See Table 5.4b, below for the variations in scholars' interpretations of the dates in the Calendar of Dionysios.

TABLE 5.4b *The Calendar of Era Dionysios with scholars' date conversions*[81]

Almagest (Toomer)	Year Era Dionysios	Ptolemy's double-dating: Dionysios/ Egyptian/ mean sun	Neugebauer's date conversion	Jones's date conversion	Toomer's date conversion
1. X.9 (502).	13	**Aigon 25/ Hathyr [III] 20/21: (mean sun 24° ♉)**	Jan 18, 272 B.C.E.	Jan 15/16, 272 B.C.E./ or Jan 17/18[82]	Jan 17/18, 272 B.C.E.
2. IX.10 (464).	21	**Scorpion 22/ Thoth [I] 18/19: (mean sun 21° ♏)**	Nov 15, 265 B.C.E.	Nov 14/15, 265 B.C.E.	Nov 14/15, 265 B.C.E.
3. IX.10 (464).	21	**Scorpion 26/ Thoth [I] 22/23: (mean sun 25° ♏)**	Nov 19, 265 B.C.E.	Nov 18/19, 265 B.C.E.	Nov 18/19, 265 B.C.E.
4. IX.7.5 (450).	23	**Hydron 21/Choiak [IV] 17/18: (mean sun; 18°♒)**	Feb 12, 262 B.C.E.	Feb 11/12, 262 B.C.E.	Feb 11/12, 262 B.C.E.
5. IX.7.7 (451).	23	**Tauron 4/ Mechir [IV] 30/ Phamenoth [VII] (mean sun 29° 30'°♈)**	April 25, 262 B.C.E.	April 26 or 27, 262 B.C.E.	April 25/6, 262 B.C.E.
6. IX.7.8 (452).	24	**Leonton 28/ Payni [X] 30, (mean sun evening 28°♌)**	Aug 23, 262 B.C.E.	Aug 21/22, 262 B.C.E.	Aug 23, 262 B.C.E.
7. IX.7.7 (451).	28	**Didymon 7/ Pharmouti [VIII] 5/6; (mean sun evening: 3°♊)**	May 28, 257 B.C.E.	May 28/29, 257 B.C.E.	May 28/29, 257 B.C.E.
8. XI.3 (522).	45	**Parthenon 10/ Epeiph [IX] 17/18; (mean sun 10°♍)**	Sept 4, 241 B.C.E.	Sept 3/4, 241 B.C.E.	Sept 3/4, 241 B.C.E.

80 Jones, "Greek Stellar and Zodiacal Date Reckoning," 164; "Posy," 287–9.

81 Astronomical dating: *Toomer, Almagest*, page numbers in col. 1 in parenthesis and date conversion in col. 6; for other conversions to B.C.E. equivalent, cf. col. 4, Neugebauer, HAMA, 1066; and col. 5, Jones, "Ptolemy's," 288.

82 Jones, "Ptolemy's," 286, 288.

The question of whether there was a leap year, and if so, where it was positioned in the cycle, is unknown. This early Ptolemaic calendar shows that there was a class of zodiac calendars in the ancient Near East and an interest among astronomers in aligning the zodiac with months and days. Furthermore, it is possible that zodiac calendars were adapted with a solar or lunar structure according to the dominant calendar of each particular culture. As the 'Dodekatemoria scheme' reconstructed by Brack-Bernsen and Steele antedates the Era Dionysios calendar, it is more likely that this scholarship travelled from Babylonia to the Hellenistic world, than the other way around. The consensus view in general is that the transmission of Greek astronomy had its roots in Mesopotamia.[83] Since Era Dionysios is a solar zodiac calendar and *4QZodiac Calendar* is lunar and it post-dates the Babylonian micro-zodiac material and uses the Babylonian-Aramaic month-names, it follows that it is more likely that 4Q318 emanated from Mesopotamia, than neighbouring Egypt. If the common source was Mesopotamia, then the conversion and creation of the solar zodiac calendar in the Ptolemaic world seems to be ingenious. It is evident that *4QZodiac Calendar* is closer to the 'Dodekatemoria scheme' and Dionysios calendar in content, astronomical elements and its technical purpose than to the 364-day schematic Jubilees-Qumran calendar scheme.

5.4.1 *Parapegmata: P.Hibeh 27; P.Rylands 589; Miletus 1; "Geminos"; Antikythera Mechanism*

The parapegmata are another source from which models of zodiac calendars possibly developed in the Classical world. A precise definition of a parapegma varies, in part, because there are many different types in antiquity: an inscribed stone or wall with placement-holes for a peg corresponding to a date; papyri; and documentary texts. They often, but not always, contain various elements of astrometeorological predictions, that is, weather information in different degrees of detail, and the lengths of day and night.[84] These weather forecasts can contain data based on the rising and settings of stars and

83 Sachs, "Babylonian Horoscopes" *JCS* 6 (1952): 71–73; Neugebauer and. Sachs, "The 'Dodekatemoria' in Babylonian Astrology," 65–66; John Steele, "Greek Influence on Babylonian Astronomy?" *MAA* 6:3 (2006): 153–160; Rochberg, *The Heavenly Writing*, 1–16, 15–20, 238–244; Jones, "Evidence for Babylonian Arithmetical Schemes in Greek Astronomy," 77–94; Toomer, "Hipparchus and Babylonian Astronomy," 353–62; Bernard R. Goldstein and Alan C. Bowen, "A New View of Early Greek Astronomy," *Isis*, 74:3 (September, 1983), 339–340. Neugebauer, *HAMA*, 613–614.

84 Liba Taub, *Ancient Meteorology* (London: Routledge, 2003), 51–52; 173–174.

constellations, sometimes citing an ancient astronomer by name as the source (Eudoxus [fl. early fourth century B.C.E.] is the most frequently cited),[85] or a generic nationality with a similar reputation, such as: the Egyptians, Greeks, Babylonians or Chaldeans. According to Evans and Berggren, the parapegma of Geminos (discussed below) is a "(star calendar) that permits one to know the time of year by the observation of the stars."[86]

Lehoux discusses in detail whether extant parapegmata apparently containing zodiac calendar data are actually based on zodiac calendar systems constructed by late fifth, and fourth century B.C.E. Greek astronomers such as: Eudoxus, Euctemon, Meton, and Callippus, who were influenced by Babylonian astronomy. This discourse is expounded by Rehm, van der Waerden, Bowen and Goldstein, and Jones.[87] Unlike the schematic 360-day zodiac calendars, the parapegmata contain months of unequal lengths. Neugebauer suggests that the allocation of different periods for the sun's journey through the zodiac signs was the parapegmatist's solution to the problem of the application of the 360-degree zodiac to a 365-day year.[88]

P.Hibeh 27

The earliest parapegma, the Graeco-Egyptian papyrus P.Hibeh 27[89] from Sais, Egypt, is dated to no later than 240 B.C.E., possibly c. 300 B.C.E.[90] It contains dates, according to the Egyptian calendar, of when the sun is in successive zodiac signs, by day and month,[91] star risings and settings, and detailed

85 Neugebauer, HAMA, 588.

86 Evans and Berggren, *Geminos's Introduction to the Phaenomena*, 2.

87 Lehoux, *Astronomy, Weather, and Calendars*, 72–87; 97; A. Rehm, "Das Parapegma des Euktemon," in *Grieschen Kalender III* (ed. F. Boll, *Sitzungsberichte der Heidelberger Akademie der Wissenschaften philosophisch-historische Klasse*; Heidelberg, 1913), 2–38; B.L. van der Waerden, "Greek Astronomical Calendars I: The Parapegma of Euctemon," *Archive for the Exact Sciences* 29.2 (1984): 101–114; A. Bowen and B.R. Goldstein, "Meton of Athens and Astronomy in the Fifth Century B.C.E.," in *A Scientific Humanist:* (ed. E. Leichty et al.; Philadelphia: OPSNK. 9, 1988), 53–63; A. Jones, "Ptolemy's" 287; A. Jones, "Zodiacal Date Reckoning," 156–162, 164.

88 Neugebauer, *HAMA*, 587–588, 628.

89 B.P. Grenfell and A.S. Hunt, *The Hibeh Papyri* Part 1 (London: EES, 1906), 138–157; Lehoux, *Astronomy, Weather, and Calendars*, 153–154, 217–223.

90 Grenfell and Hunt, *The Hibeh Papyri*, 139, give the latest date of 240 B.C.E., but add that it may be a few decades earlier: 301–288, the period to which the calendar refers.

91 Jones, "Ptolemy's" 287 (2006), he also states that the dates refer to the sun's entry into the zodiac signs according to the Egyptian calendar, "showing that the zodiacal division of the year was already practised in the early third century B.C.E.," elsewhere, Jones states

mathematical data about day and night lengths, and cultic feast days. The following is an extract:

> **Tybi**
> [...]: (The sun is) in Aries
> 20th: Vernal equinox; the night is 12 hours, the day 12. The feast of Phitoroius.
> 27th: The Pleiades set acronychally; the night is $11^2/_3$+ 1/6 + 1/90 hours, the day is $12^1/_{10}$+ 1/30 + 1/45[92]

Our interest is in the fact that the earliest known extant parapegma, included information about the position of the sun in the zodiac and its corresponding date (the vernal equinox). As it is contemporary with the calendar of Dionysios, or from the generation before, it suggests that there was an evident interest in developing zodiac calendars in the Hellenistic world at least from the time of the Ptolemy I Soter (305–282 B.C.E.).

P.Rylands 589

The second century B.C.E. Greek papyrus from Egypt, P. Rylands 589[93] is extremely interesting as it contains solar zodiacal and lunar cycles woven onto the attested 25-year cycle of the Egyptian civil calendar, which is non-zodiacal.[94] Turner and Neugebauer state that the text contains the earliest use of this calendar, and that it was used in later astronomical texts [without the zodiacal elements], including the *Almagest*.[95]

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that the sun's entry into the signs was incorporated into papyrus and that it did not exist in the original scheme, "Zodiacal Date Reckoning," 161–162 (2007).

92 P. Hibeh 27, col. 4, in Lehoux, *Astronomy, Weather and Calendars*, 217, 220.

93 E.G. Turner and O. Neugebauer, "Gymnasium Debts and Full Moons," *BJRL* 32 (1949): 80–96. Formerly P. Ryl. Inv. 666. (The papyrus also lists the accounts for a gymnasium); Lehoux, *Astronomy, Weather and Calendars* 179–180; (translation) 476–477.

94 The calendar, without the zodiac elements, appears to be the standard Egyptian calendar, described by Turner and Neugebauer in "Gymnasium Debts," 84–85, and Neugebauer, *Exact Sciences*, 90, 95, 164: the cycle consisted of 309mean lunar months which are equivalent to 9125 days and 25 Egyptian calendar years of 365 days, without intercalations or leap days. Every 9125 days the date of the lunar month in the lunar calendar would coincide with the same as the date of the civil month; Neugebauer, *HAMA*, 563–564.

95 Turner and Neugebauer, "Gymnasium Debts," 82.

They date the calendar to probably the summer of 180 B.C.E., the first regnal year of (the-then five-year old) Ptolemy VI Philometor.[96] A legible preamble explains how the calendar concerned works with an explanation of what will follow. There is a list of full and hollow months, extant for parts of the second and fourth years, and further broken columns. The months are based on observation: according to Turner and Neugebauer the month-lengths are real, that is determined by the moon, not schematic: the first line of col. 10, frag 5 (line 125 in their reconstruction) κατὰ σ[ελήνην νουμη]νίαι,[97] refers to real, full and hollow months. The months are aligned to the sun's position in the zodiac signs and the dates given for the new moon falls on the 19th or 20th of the solar month [possibly the beginning of the zodiacal solar months] (also col. 10, frag. 5). In contrast, in the 25-year Egyptian civil calendar, the term νουμηνίαι (*noumenia*, new moon) alone was used to signify the first day of an Egyptian civil month, which was not regulated by the actual moon.[98]

The following are extracts from the text restored and translated by Turner and Neugebauer (without reconstruction marks):[99]

> (Column 9, frag. 4):
>
> A parapegma of the beginnings of lunar months as they are ordered according to the days of the Egyptian year of which the cycle is twenty-five years, having 309 months including intercalary months, or 9,125 days.

96 Lehoux (trans) *Astronomy, Weather and Calendars*, 476–477. Cf. Turner and Neugebauer reconstruct and translate the first line of frag 4, col. 9, lines 92–111, as: "Year 1 of Queen Cleopatra and King Ptolemy the son, gods Epiphaneis" and the last line as: "The first year of the period is the same as the first year as reckoned by Queen Cleopatra and King Ptolemy the son, god Epiphaneis, in which they also took over the kingdom." The latest date for Ptolemy V Epiphanes Eucharistos is May 20, 180 B.C.E., Turner and Neugebauer, *New Moons*, 82, 95.

97 Turner and Neugebauer, "Gymnasium Debts," 92; αἱ δὲ κατὰ σ[ελήνην νουμη]νίαι Lehoux, *Weather and Calendars*, 475. Turner and Neugebauer state: "The addition of κατὰ σελήνην obviously means that we are dealing here with phenomena of the real lunar calendar, in contrast to any civil calendar which is not regulated (either through observation or indirectly by computation) by the real moon," "Gymnasium Debts," 86, and n.1; Sacha Stern argues that "this is a misinterpretationof *kata selenen*. The phrase refers to a lunar calendar month that has not been tampered with." (Private communication). A.C. Bowen and B.R. Goldstein, "Aristarchus, Thales and Heraclitus on solar eclipses: an astronomical commentary on P.Oxy. 53.3710 cols. 2.33–3.19," *Physis*, new ser. 31(1994): 689–729. (I thank Prof. Stern for this reference).

98 Turner and Neugebauer, "Gymnasium Debts," 85–86.

99 Lehoux (trans) *Astronomy, Weather and Calendars*, 476–477.

It shows the months according to the moon, and which of these will be full, which hollow, and which intercalary, and in which zodiacal sign the sun will be in for each month. When twenty-five years have passed, it will go to the same beginning, and it will change in the same way. The first year of the cycle is the same as the first year that queen Cleopatra and king Ptolemy the younger were taken as gods manifest and in which they received the kingdom . . . .[100]

(Column 10, frag 4):

month [. . . .
Thoth: Scorpio
Phaophi: Sagittarius
Athyr: Capricorn
Choiak: Aquarius
Tybi: Pisces
Mecheir: Aries

(Column 10, frag 5, lines 125–30)

For the first year the beginning of the months[101]
according to the moon are:

Thoth: 20th [. . .
Phaophi: 19th [. . .
Athyr: 19th [. . .
Choiak: 19th [. . .

100 Lehoux (trans), *Astronomy, Weather and Calendars*, 476. Cf. Turner and Neugebauer reconstruct and translate the first line of frag 4, col. 9, lines 92–111, as: "Year 1 of Queen Cleopatra and King Ptolemy the son, gods Epiphaneis" and the last line as: "The first year of the period is the same as the first year as reckoned by Queen Cleopatra and King Ptolemy the son, god Epiphaneis, in which they also took over the kingdom." The latest date for Ptolemy V Epiphanes Eucharistos is May 20, 180 B.C.E. (Turner and Neugebauer, "Gymnasium Debts," 82, 95).

101 αἱ δὲ κατὰ σ[ελήνην νουμη]νίαι

(Column 11, frag 6)	(Column 12, frag 6)	
For the second]		
ye[ar]:		
Thoth . . .	. . .] 29 [da]ys	[Pharmouthi
Pha[ophi . . .	. . .]30 [day]s	P[achon
Athy[r . . .	. . .]30[day]s	[Payni . . .
Choia[k	. . .]29[day]s	[Epeiph . . .
[Tybi . . .	. . .]30 [da]ys	M[esore
[Mecheir	. . .]29[day]s	[For the fourth] y[ear]

It is a rather lovely calendar: 9,125 days divided by 309 months = 29.53 days per month, and 9,125 days divided by 25 = 365, the number of days in the Egyptian year. Turner and Neugebauer state that the text confirms that this calendar goes back to the early second century B.C.E.; it was known from later astronomical texts: the second century C.E. demotic papyrus Carlsberg 9 and Ptolemy's *Almagest*.[102]

> . . . any fixed relation between 30-day months and zodiacal signs can be no more than approximately correct not only because the sun travels less than 360° in 360 days but also because the solar movement is slower near the apogee in Gemini and faster at the perigee in Sagittarius. But aside from these small corrections, the months of the Egyptian calendar change their position with respect to the seasons comparatively so rapidly that a co-ordination of months and zodiacal signs can have only a very limited validity.[103]

Nevertheless, the association of months and zodiacal signs is very common in all calendars of a luni-solar character. An extreme case is the calendar of Dionysius (time of Philadelphus) where the months are named after the signs of the zodiac.[104]

102 Turner and Neugebauer, "Gymnasium Debts," 82; O. Neugebauer and A. Volten, "Ein demotischer astronomischer papyrus (pap.Carlsberg 9)," *QS* B 4 (1938): 383–406; Neugebauer, *Exacts Sciences in Antiquity*, 90, 95, 164; Neugebauer, *HAMA*, 663–664; Stern, *Calendars in Antiquity*, 152–153, 157–158.

103 Turner and Neugebauer, "Gymnasium Debts," 83.

104 Turner and Neugebauer, "Gymnasium Debts," 83 n. 3.

Commenting on the correlation of the solar months to the signs of the zodiac, Turner and Neugebauer state that although the solar zodiac is schematic, it is functioning (albeit the seasons retrogress in the Egyptian 365-day year, by about one day every four years).[105] They conclude by confirming that a zodiacal calendar could still work in the Egyptian wandering year:

> Thus we have to accept the fact that correlations between the zodiac and the wandering year were not considered without value in spite of their short-lived character.[106]

Turner and Neugebauer's observations are particularly resonant for 4Q318 whereby the months are aligned to the zodiac. In both calendars, the sun, the moon and the zodiac are calendrically interrelated. Whereas 4Q318 is comprised of schematic luni-solar years and luni-zodiacal days and months, P. Rylands 589 is composed of schematic solar-zodiacal months, solar-lunar years (25 years, 309 months), and actual lunar months (real full and hollow months), reflecting an astronomical variant on the Egyptian 25-year cycle, the new calendar. One may ask why the 25-year cycle in this papyrus, the first attested primary source of its kind, lost its zodiacal elements.

Miletus I

From Greece, Miletus I is the only extant inscriptional parapegmata with zodiacal data;[107] it is comparatively late, 110–109 B.C.E. There are placement holes for a peg instead of written lists of dates. The inscriptions list stellar risings and settings, winds and the date that the sun enters the zodiac indicated by the peg in the hole. The best-preserved fragment for which the peg-holes for the sun in a zodiac sign are extant or can be reconstructed (Inv. 456 B) runs across three columns and includes Sagittarius [part-restored], Aquarius (extant) and Aries.[108]

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105 Turner and Neugebauer, "Gymnasium Debts," 83 n.3.

106 Turner and Neugebauer, "Gymnasium Debts," 84.

107 Lehoux, *Astronomy, Weather and Calendars*, 180–181, 478–480; idem, "The Miletus Parapegma Fragments," *ZPE* 152 (2005) 125–140; H. Diels and A. Rehm, "Parapagemenfragmente aus Milet," *Sitzungsberichte der koniglich preussischen Akademie der Wissenschaften, philosophisch- historische* Klasse 23 (1904), 92–111; H. Dessau, "Zu den Milesischen Kalenderfragmenten," ibid., 266–268.

108 See Lehoux, *Astronomy Weather and Calendars*, 478–479, and idem, "The Miletus Parapegma," Fig. 1, 128.

The "Geminos" Parapegma

Although it was appended to the end of the *Introduction to the Phenomena*, the 'Geminos' Parapegma, a literary work, the consensus is that it is probably written by an earlier astronomer than Geminos,[109] who is believed to have flourished in the first century B.C.E.[110] The parapegma cites no source later than the third century B.C.E.; in particular, Hipparchus is not mentioned as an authority. The main astronomers cited are Eudoxus, Euctemon and Kallippos.

There is no scholarly agreement on the authorship of the text and, based on the authorities that it notes it may be dated to shortly after 200 B.C.E., that is, before Hipparchus.[111] In the 'Geminos' Parapegma, the 365 day-year is divided into 12 zodiac signs of apparent similar length. The sun is said to take between 29 and 32 days to traverse different signs, more days in the summer and fewer days in the winter (for example Sagittarius in 29 days, Taurus in 32 days).[112] Although a solar zodiacal work—calendrical days of the month are listed within the infrastructure of solar zodiac months—it is very different to 4Q318. Its function is to record the risings and settings of the constellations and accompanying meteorological conditions. Our interest here is simply in recording a Hellenistic interest in different forms of zodiac calendar material.

This section examined Hellenistic zodiac calendars in different forms and found that there was a broad common interest in this genre throughout the Mediterranean region from the early third century B.C.E. The Calendar of Dionysios may be a solar version of the tradition reflected in *4QZodiac Calendar*. None of the Ptolemaic or Greco-Roman primary source material is comprised of a calendar with a secondary text and it is noticeable that there are no accompanying omen texts (such as a brontologion).

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109 Neugebauer, *HAMA*, 580, 587–588; Jones, "Zodiacal Date Reckoning," 158; Lehoux, *Astronomy, Weather and Calend*ars op. cit., 157–158, 226–232, 233–239 (trans).

110 Evans and Berggren, *Geminos's Introduction to the Phenomena*, 2006.

111 In the view of Evans and Berggren, the "Geminos" parapegmatist antedates Geminos. Evans and Berggren *Geminos's Introduction to the Phenomena* give a full list of the parapegmatist's sources and the number of citations per authority. They argue that it is possible that Geminos did not have access to Hipparchus's parapegma, there was no interruption at the end of the book (citing G. Aujac, ed. and trans. *Geminos, Introduction aux phénomènes* {Paris: Les Belles Letters, 1975} 175), and that therefore the question of authorship should be left open (275–276, 276 n. 4). Lehoux suggests that although he may not have written it, Geminos was responsible for its inclusion (Lehoux, *Astronomy, Weather and Calendars*, 157).

112 Lehoux, *Astronomy, Weather and Calendars*, 226–239, 223; Evans and Berggren, *Geminos's Introduction to the Phenomena*, 275–289.

The Antikythera Mechanism

Evidence for zodiac calendars from archaeological objects is extant in one of the most remarkable artefacts yet recovered. Derek J. de Solla Price, the scholar who wrote the first modern study of the world's oldest-known geared mechanism, the Antikythera Mechanism, called the device an ancient Greek "calendar computer."[113] It was discovered at the turn of the 20th century in a shipwreck that had occurred in antiquity, possibly in the first decades B.C.E., off the coast of a Greek island. The find, currently in the National Archaeological Museum in Athens, was among a hoard of treasures, mainly of marble and bronze sculptures.

Price had dated the "ancient Greek computer" to c. 80 B.C.E.

His research has been superceded by major advances in technology reflected in the work of Michael T. Wright (with the late A.G. Bromley)[114] and the international Antikythera Research Mechanism Project team who published their preliminary findings using surface imaging (an X-ray method which enables viewing beneath the surface, provided by Hewlett-Packard), to produce clear images of gear-work and epigraphy from the corroded bronze fragments.[115] The bronze machine, believed by a proportion of modern researchers to have been made by, or during the period of Hipparchus (190–126 B.C.E.), has been re-dated to 150–100 B.C.E. on the basis of the epigraphic style of the engraved Greek lettering and the team's claim that the lunar model of the moon's motion simulates that of Hipparchus.[116]

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113 Derek J. de Solla Price, "Gears from the Greeks: The Antikythera Mechanism—A calendar computer from ca. 80 BC," *Transactions of the American Philosophical Society*, 64:7 (1974): 1–70 (reprinted by Science History Publications, New York, 1975); idem, "An Ancient Greek Computer," *Scientific American* 200: 6 (June, 1959): 60–67.

114 M.T. Wright and A.G. Bromley, "Towards a Reconstruction of the Antikythera Mechanism," in *Extraordinary Machines and Structures in Antiquity* (ed. S.A. Paipetis, Peri Technon: Patras, 2003); 81–94; M.T. Wright, "The Antikythera Mechanism reconsidered," *Interdisciplinary Science Review*, 32:1 (2007), 27–43 (full bibliography in *Nature*, "Decoding," 591, note below).

115 T. Freeth et al., "Decoding the ancient Greek astronomical calculator known as the Antikythera Mechanism," *Nature* 444 (Nov 2006), 587–591 online PDF: http://www.nature.com/nature/journal/v444/n7119/pdf/nature05357.pdf; also F. Charette, "Archaeology: High tech from Ancient Greece," *Nature* 444, 551–552 (30 November 2006); N. Kollerstrom, "Decoding the Antikythera Mechanism," *Astronomy Now* (March, 2007), 28–31.

116 According to Charalambos Kritzas, Director Emeritus of the Epigraphic Museum, Athens, in Freeth et al. "Decoding," online link to Supplementary Notes 2 (glyphs and inscriptions) http://www.nature.com/nature/journal/v444/n7119/suppinfo/nature05357.html; Charette, "Archaeology: high tech from Ancient Greece," 551–552.

The great front dial displays two concentric scales ("Fragment C" of the remains, see Figure 5.4.1). The inner scale, which is fixed, shows the Greek zodiac with 360 divisions. Price observed that the signs are marked off in degrees in groups of 30; he could discern Greek letters above the degree-divisions using X-rays and early original photographs.

Advanced imaging techniques have allowed more inscriptions to be seen; ΧΗλΑΙ (Chēlai), Libra, (Claws of the Scorpion) is visible to the naked eye at the top of the inner scale directly beneath the days of the month in the outer dial.[117] Price pointed out that the signs are arranged in a clockwise order, the reverse sequence to that attested in [most] later zodiacs.[118] The outer ring, which was designed to be moveable, is a calendar engraved with the Egyptian month-names in Greek letters with corresponding days, also in groups of 30. Later research claims that the calendar ring is marked off in 365 days, according to the Egyptian calendar, which was in standard use in Greek astronomy.[119] In addition to ΧΗλΑΙ the part of [ΠΑΡΤΗΕ]ΝΟ[Ν] (Parthenon) (Virgo) to the far left edge on the ring[120] is visible to the eye, and recently, with surface imaging, ΣΚΟΡΠΙΟΣ (Scorpio) can be seen to the right of Chēlai followed by Sagittarius (Toxotês). It is partially covered by a parapegma detailing the dates of first and last visibilities of particular stars when the sun was at certain degrees in the zodiac.[121] The signs are thus engraved in an clockwise direction, Virgo–Claws–Scorpio, and are marked off in degrees in groups of 30, beginning at 1° of the sign.[122] As Price notes, this is in opposite orientation to the classical zodiac

117 Kollerstrom, "Decoding," 30 (the reading of Scorpio is not attested in Price; and Kollerstrom reads the last Ns of Parthenon); Price, "Gears," 17–18; R. Hannah, *Time in Antiquity* (London: Routledge, 2009), 48–49 and reference to Hewlett Packard site containing publically available images: http://www.hpl.hp.com/research/ptm/antikythera_mechanism/full_resolution_ptm.htm. (image no. AK31a). or the link via the team's website: http://www.antikythera-mechanism.gr/.

118 Price, "Gears," 18.

119 Freeth et al., "Decoding," 588; Wright, "Reconsidered," 32; The Egyptian year 12 months of 30 days each plus five addition days without leap years regressed through the seasons: making a complete cycle in about 1460 years (365 x 4), known as the Sothic period: Evans, *History and Practice of Ancient Astronomy*, 175–176; A. Pannehoek, *A History of Astronomy*, (London: Allen and Unwin, 1961), 82–84.

120 See also, Price, "Gears," 17, Fig. 7.

121 T. Freeth and Alexander Jones, "The Cosmos in the Antikythera Mechanism," ISAW Papers 4 (February 2012), page 4, 11–12 of 67 [article unpaginated]. online. Accessed 12 July, 2013. http://dlib.nyu.edu/awdl/isaw/isaw-papers/4/.

122 Price, "Gears," 17–19, see Table 1, 19; Charette, "Archaeology: high tech from Ancient Greece," confirms, "Freeth and colleagues clarify the function of the front and back dials

in "later instruments and horoscopes"[123] whereby the signs move anti-clockwise from the eastern horizon point (as shown in P.Oxy 235, in the previous chapter).

The outer ring, which was designed to be moveable, is a calendar engraved with the Egyptian month-names in Greek letters, with corresponding days, also in groups of 30. It was this discovery which led Price to call the mechanism a "calendar computer." The inscribed consecutive month names on the outer scale that are visible are ΠΑ[ΥΝΙ] (Pa[yni]) to above right of Chēlai and the possible final letters of [ΠΑΧ]ΟΝ ([Pach]on), above left.[124]

> The front dial . . . has two scales, one of which is fixed and displays the names of the signs of the zodiac; the other is on a moveable slip ring and shows the months of the year. Both scales are carefully marked off in degrees . . . . Clearly this dial showed the annual motion of the sun in the zodiac.[125]

Freeth et al's view is that the mobile calendar ring would be adjusted to take into account the solar year of approximately 365¼ days: the extra quarter day per year could be corrected by moving the scale backwards by one day every four years.[126] This reconstruction may be problematic because the Julian calendar, which was designed to take to take these adjustments, was not introduced until 45/ 46 B.C.E. (and then, it was implemented inaccurately).[127] The team's theory has been refined as a result of advanced imaging leading, to the discovery that the mechanism presented the four-yearly Olympiad Cycle.[128]

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of the mechanism: the front were graduations for the zodiac and the solar calendar, and pointers for the Sun and Moon with an indication of the lunar phase," 551–552.

123 Price, "An Ancient Greek Computer," 17–18, Fig. 7 and Fig. 8; now also see the computer aided design reconstruction by T. Freeth, Fig 4, "Cosmos in the Antikythera Mechanism", page 8 of 67, and the reconstructions by M. Wright, D. Kriaris and others in the National Archaeological Museum of Athens.

124 Price, Gears from the Greeks," 18, see fig. 8.

125 Price, "An Ancient Greek Computer," 63.

126 Freeth et al., "Decoding," 588.

127 After Julius Caesar's death in 44 B.C.E., the pontifices implemented the leap year every three years–fourth by inclusive counting in the Roman method of reckoning. It was finally corrected in 8 C.E., Blackburn and Holford-Strevens, *Oxford Companion to the Year*, 670–1.

128 Freeth et al., "Olympiad Display," Supplementary Notes, 19–22; Robert Hannah, *Time in Antiquity* (London: Routledge, 2009), 47.

FIGURE 5.4.1 *Detail of the degree divisions of the zodiac (inner ring) and solar calendar (outer ring) in Fragment C of the Antikythera Mechanism. Inscriptions can be discerned (Courtesy of the Antikythera Mechanism Research Project. Website: www.antikythera-mechanism.gr).*

Wright concurs that the ring kept track of the solstices and equinoxes, which slipped backwards by one day every four years in the Egyptian civil calendar.[129] He is not in agreement with the earlier dating by the team of the mechanism.[130]

Price had dated the mechanism to c. 80 B.C.E. on the basis of the difference in degrees between the two rings, as a result of the clock having stopped, as it were, in 82 B.C.E. He noted that the autumnal equinox at Libra 0° (Chēlai) is aligned with 13½° Pachon in the Egyptian wandering year and calculated the date of 80 B.C.E. date based on data and records from Hipparchus in Ptolemy's *Almagest*.[131]

The remains of an inscribed astronomical calendar, a "parapegma" plate, which lists the risings and settings of the constellations and zodiac signs on dates according to the sun's degree in the zodiac (cf. the Calendar of Dionysius), was identified by Price on the front dial:

> As the sun enters each marked degree of the zodiac, the parapegma calendar tells us the heliacal risings and settings of the most noticeable bright stars.[132]

129 Wright, "Reconsidered," 35.

130 Private communication.

131 Price, "Gears," 18–19.

132 Price, "Gears," 16–19.

Hannah has produced a reconstruction of the significance of the visible Greek letters on the inner dial above the degree divisons, suggesting that they indicate the autumn equinox and the morning and evening risings and settings of the stars.[133] An extract is as follows:

A Libra 1 Autumn equinox
B Libra 8 Pleiades evening rise
Γ Libra 22 Hyades evening rise?
Λ Scorpio 8 Arcturus evening rise?
E Scorpio 19 Pleiades morning set
Z Scorpio 29 Hyades morning set[134]

He suggests that the Antikythera Mechanism may have had an astrological purpose, arguing that the device provided a means of determining the position of the planets in ephemerides.[135] Wright also claims that the mechanism may have had an astrological use and that the instrument could be used as a planetarium, which reconstructed the motion of the planets, possibly replacing a written ephemeris, to cast horoscopes.[136] In their latest paper, Freeth and Jones argue that the sun, moon and the five planets, Mercury, Venus, Mars, Saturn and Jupiter were represented by semi-precious stones in the gearwork on the front dial inside the zodiac ring, a suggestion borne out by the inscription on the back dial.[137]

The front face further incorporates a sun and a moon pointer, first noted by Wright; he argues that these were fixed by means of pin-and slot mechanisms, which displayed the sun and moon's respective mean positions in the zodiac, the latter also displayed the phases of the moon on a little black and silver revolving ball.[138]

The front and back dials display glyphs and markings indicating the luni-solar calendar sequence comprising 235 synodic months of the 19-year Metonic cycle (when the moon returns to the same position in the zodiac at the same phase), the 76-year Callippic cycle (four years of the Metonic cycle, minus one day), the Olympiad Cycle, the "Saros" lunar eclipse cycle of 223 months (just

133 Hannah, *Time in Antiquity*, 48–49. See also Price, "Gears" 18, Fig. 8.
134 Hannah, *Time in Antiquity*, 56–7 (after Price, "Gears," 46, Table 4).
135 Hannah, *Time in Antiquity*, 62.
136 Wright, "Reconsidered," 37, 40.
137 Freeth and Jones, "The Cosmos in the Antikythera Mechanism," 1–9, 12–17.
138 M.T. Wright, "The Antikythera Mechanism and the Early History of the Moon-Phase Display," *Antiquarian Horology*, 29:3 (March 2006) 319–329.

over 18 years) and the 54-year Exeligmos cycle (three Saros cycles), and there are attempts at marking full (30-day) and hollow (29-day) months.[139] There is an intriguing inscription at line 30, transcribed by Kritzas, which refers to 20-something number of days to be excluded from the calendar:

> 30. and days to be excluded. 2? (twenty to twenty-nine; "excluded" means "taken out of the calendar")[140]

This could suggest an interesting calendrical cycle in which adjustments were made by subtracting days, instead of adding them on as a matter of course. There are also glyphs indicating when solar and lunar eclipses would occur: Σ (S) for a lunar eclipse, based on ΣΕΛΗΝΗ (Selene, the moon); and H (H) for a solar eclipse, based on ΗΛΙΟΣ (Helios, the sun); these are accurate if based on historic eclipse data in which the lunar month began at first crescent.[141] Freeth et al., explain that the Babylonian Saros Canon is the "only known source of sufficient data to construct the dial."[142] The lower back dial is marked with geographical references, possibly indicating the region where an eclipse might occur.

According to Wright, the displays might have been used to compare the Egyptian solar calendar with different, local lunar calendars.[143] Of note, he observes that there is no evidence of a 354-day or 360-day year among the gear wheels. This idea is interesting in the light of the synchronised calendar texts in the Dead Sea Scrolls. If Wright is correct, it is evidence of a possible preoccupation by ancient astronomers, or a cross-cultural norm to co-ordinate the

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139 Freeth et al., "Decoding," 587–591 and Supplementary Note 2 (glyphs and inscriptions); "Olympiad Display," 614–617.

140 Supplementary Note 2 (glyphs and inscriptions) online, op. cit., 13.

141 Freeth et al., "Decoding," 589.

142 Freeth et al., "Decoding," 589. The Babylonian Saros Canon records data from the early fifth century to the mid-third century B.C.E., {see A. Aaboe et al., "Saros Cycle Dates and Related Babylonian Astronomical Texts," *Trans. Am. Phil. Soc.* 81: 6 (1991), 1–75; F.R. Stephenson, *Historical Eclipses and Earth's Rotation* (Cambridge: Cambridge University Press, 1997); J.M. Steele, *Observations and Predictions of Eclipse Times by Early Astronomers* (Dortrecht: Kluwer Academic Press, 2000); idem, "Eclipse Prediction in Mesopotamia," *Arch. Hist. Exact. Sci* 54 (2000): 421–454}.

143 M.T. Wright, "Counting Months and Years: The Upper Back Dial of the Antikythera Mechanism," *Bulletin of the Scientific Instrument Society*, 87 (December 2005), 8–13. Idem, "Understanding the Antikythera Mechanism," *Proceedings of the 2nd International Conference on Ancient Greek Technology, Athens, 17–21 October, 2005* (Athens: Military Museum, 2006), 49–60 (preprint, AntikytheraWright. Pdf. online 1–9).

various calendrical systems in the region.[144] In his view, there were earlier prototypes of the machine as it is too sophisticated to have been made on a trial-and-error basis *ex nihilo*.[145] His hypothesis may be supported in the writings of Cicero (fl. 80–43 B.C.E.), particularly with reference to an astronomical sphere created by Archimedes (3rd century B.C.E.), which displayed the motions of the sun and moon and the five planets (Cicero, *Republic* 1.21–22, 28; *Tusculan Disputations* 1.25)[146] and an orrery presented, by Posidonius (fl. 135–51 B.C.E.) (*The Nature of the Gods* 2.87–8).[147] Freeth and Jones accept the testimony of Cicero that there were indeed mechanisms in the first century BC that displayed the revolutions of the sun and the moon and the five planets, though they reject the theory that Archimedes made the prototype ca. 166 B.C.E.[148]

The relevance of the Antikythera Mechanism for 4Q318 is the alignment of the moveable, 365-day solar calendar-ring with the degree-division of the zodiac signs in the fixed, inner ring. The use of the zodiacal dates means that its calendar was based on the zodiac degree of the sun, like the solar zodiac calendar of Era Dionysios. Although the mechanism's zodiac calendar is solar, there is an interest in lunar cycles as attested on the back dial, although not the lunar calendar. It would, however, determine a precise position for the sun and the moon in the zodiac on any given date within the matrix of a 365¼-day solar calendar, which could be synchronised with different lunar cycles.

The lunar zodiac calendar of 4Q318, although a far humbler artefact, would not be intended for display, but it could be memorised. Its existence in Aramaic is evidence of the wide interest in variant zodiac calendars in the second century B.C.E., and later, in the region, that are culturally biased towards either the sun, or the moon.

144 Private communication.

145 Idem, "Understanding," 8 (preprint).

146 Cicero, *Republic*. 1.21–22, 28 (LCL, Keyes); *Tusculan Disputations*. 1.25 (King, LCL); Hannah, *Time in Antiquity*, 63–64.

147 Cicero, *Nature of the Gods*. 2.88 (Rackham, LCL). [Various out of copyright publications: 2:34]; Hannah, *Time in Antiquity*, 63–64.

148 Freeth and Jones, "The Cosmos in the Antikythera Mechanism," 9–10. Evidence for an astronomical mechanism from Cicero in *De Natura Deorum* (Nature of the Gods) 2.34–35 (87–88); *Tusculan Disputations* 1.63 and *De Re Publica* (Republic) 1.14 (21–22) but their descriptions do not compare with the extraordinary phenomenon of the Mechanism.

5.5 Summary and Conclusion

It may be inferred from the texts and materials discussed in this chapter that there was a strong interest in the sun and moon's daily position in the zodiac in the Hellenistic and Hellenistic-Jewish world. Both Philo and Josephus showed knowledge and familiarity with the concept of zodiac calendars. Philo's erudition on the subject has noticeably greater depth[149] and displayed an accurate understanding of the micro-zodiac scheme that is also reflected in 4Q318. They both attributed a theological dimension to calendrical astronomy and the zodiac. The solar and lunar zodiac had a place in their theology and in their understanding of the biblical festival calendar. This argument implies that the zodiac was not regarded as a pagan construct prohibited in Second Temple Judean culture and in Hellenistic Jewish society. Instead, it had a legitimate place in its belief system.

My analysis demonstrates that the intellectual background of *4QZodiac Calendar* was consistent with the scientific culture in the wider society throughout the Mediterranean during the late Herodian period. It is suggested that zodiacal science flourished and was actively promoted during the reign of Augustus, who was contemporary with the time that 4Q318 was copied. It was also elementary education: Strabo insisted that his readers understood the astronomy of the zodiac and the celestial sphere before they read his opus.

The Greek literary zodiacal material, such as Vitruvius, are not analogous to 4Q318 as composite texts with omens but there are affinities with *4QZodiac Calendar*, particularly in the recurring formulae of how the sun and moon orbit the zodiac. The solar-lunar Ptolemaic zodiac calendars of Era Dionysios, P. Rylands 589 and the highly sophisticated Antikythera Mechanism, all of which are different to each other, and *4QZodiac Calendar* but they all have in common systems of co-ordinating calendrical cycles of the sun, moon and the zodiac.

In contrast to the corpus of Byzantine Greek *selenodromia* and *brontologia* that are almost identical to 4Q318 as explored in Chapter 2, related omens and the generic culture of zodiac calendars with dependent secondary omen texts are absent in Hellenistic primary sources (as far as is known). It would, therefore, be insecure to suggest that the Qumran scroll was derived from Greco-Roman origins. In contrast to Pingree's view in the critical edition of 4Q318, I conclude that there is no evidence with which to claim that *4QBrontologion* and the copies of Greek Byzantine brontologia could have emanated from a

149 See also J.E. Taylor with D. Hay, "Astrology in Philo of Alexandria's *De Vita Contemplativa*," ARAM 24.2 (2012), 293–309.

common source,[150] except perhaps Seleucid Hellenistic texts, but no parallels have yet emerged.

Since no close prototype to 4Q318 as a combined calendar and omen text is attested in either Mesopotamian or Greek Hellenistic sources, it is possible that copies of *4QZodiac Calendar* were composited with *4QBrontologion* by an Aramaic-speaking group in Judea who were aware of the *Kalendertexte* and Mesopotamian archaic-style omen texts. The omina do not appear to have reached Greco Roman or Ptolemaic society in the last centuries B.C.E. The earliest possible sighting remains the Oxford brontologion, consisting of a single zodiacal conditional clause and prediction which may have been added to its parapegma in 14–15 C.E., but it is probably more likely to have been included in this Byzantine copy by a medieval copyist and scholar who edited the material together, as discussed in Chapter 2.

150 Pingree, "Astronomical aspects," DJD 36, 272.

CHAPTER 6

A Late Medieval Astrological Hebrew Text

6.1 Introduction

Up until this point, this research has focussed on Babylonian, Hellenistic, Qumran and correlative Byzantine Greek texts related to 4Q318. This chapter presents and investigates a similar, but unpublished, fifteenth century astrological and calendrical medical Hebrew manuscript from that I found during the course of this research.[1] The text from the Bodleian Library, University of Oxford: MS. Opp. 688, fol. 162v had been originally catalogued by Neubauer and Cowley; but its new description by Beit-Arié in a modern catalogue was particularly informative.[2] The folio contains a table of the moon's position in the zodiac for every day throughout a schematic 360-day year; the month names are the Aramaic Babylonian month names, as they are in *4QZodiac Calendar* (and the Hebrew calendar) and there is an integrated astrological medical text.

There are strong similarities between *4QZodiac Calendar* and the zodiac calendar of Opp. 688 (hereafter Opp. 688 'Zodiac Calendar'). Unlike *4QZodiac Calendar*, the lunar table in Opp. 688 is drawn up in a tabular grid, which makes it quite easy to use, rather than written out in full as with 4Q318.

This chapter will describe the calendar's technical structure before moving on to analyse the content of the astrological medical component and the paleography. I then explore Opp. 688 'Zodiac Calendar' in further detail and compare its content with that of *4QZodiac Calendar* and the 'Dodekatemoria scheme.' The data are compared with those in the Babylonian horoscope texts, to replicate the experiment in Chapter 1. Finally, the composited late medieval Hebrew text is considered in relation to the combined elements of 4Q318.

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1 I am very grateful to Justine Isserles for reading this chapter and for sending me some relevant newly published and forthcoming material on the lunar zodiac calendar and astrological medicine in medieval Hebrew manuscripts.

2 No. 2123, paragraph 5a, in A. Neubauer and A.E. Cowley, *Catalogue of the Hebrew Manuscripts in the Bodleian Library* (Vol. 1; Oxford: Clarendon, 1906), 727; also, *Catalogue of Hebrew Manuscripts in the Bodleian Library. Supplement of Addenda and Corrigenda to Vol. 1* (*A. Neubauer's catalogue*) compiled under the direction of M. Beit-Arié, (ed. R.A. May; Oxford: Clarendon, 1994), col. 394.

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6.2 Introduction to MS. Opp. 688, fol. 162v

This manuscript is part of a hand-written, hand-made book, encased in white paper, containing medical treatises, notes and recipes from Byzantium. The book contains folios of approximately quarto size[3] written in several hands in Sephardi, Ashkenazi and Byzantine scripts. Several folios have different dates in the 1460s;[4] one folio is written in Spanish, another uses French words (both in Hebrew script).[5] It is known that Byzantium was a centre during the medieval period for Hebrew authors who wrote treatises on astronomy, medicine, philosophy and theology, and translated scientific material from Arabic into Hebrew.[6]

MS. Opp. 688, fol. 162v consists of a lunar zodiac calendrical table comprised of a grid of 17 rows and 14 columns with the numerical days of the month and the Aramaic-Babylonian month names (see Figure 6.2.3). The final two rows spell out the names of the Hebrew signs of the zodiac (row 16) and the names of parts of the body beneath each sign (row 17). Beneath the graph are five lines of a corrupt text about the moon, stars, the zodiac and the lunar calendar. This text does not mention any particular zodiac signs, or any physiological matters; it may not be directly connected to the table.

6.2.1 *Melothesia*

The final two rows 16 and 17 (hereafter Opp. 688 'Zodiac Man,') an astrological system known as melothesia, assigns areas of the body to the planets and zodiac signs in descending order, beginning with Aries for the head and ending in Pisces for the feet.[7] It is possible that the idea of associating areas of the human body to the heavenly bodies was known in Mesopotamia.[8] The system of linking anatomical parts to zodiac signs from head to toe is evident in Manilius's *Astronomica*,[9] although the astrological epic poem itself was not

3 Quarto is 19.9 cm × 15.2 cm.

4 Beit-Arié, *Catalogue*, 394.

5 Neubauer and Cowley, *Catalogue*, 727.

6 B.R. Goldstein, "The Medieval Hebrew Tradition in Astronomy," *JAOS* 85.2 (1965): 145–148.

7 O. Neugebauer, "Melothesia and Dodekatemoria," in *Astronomy and History* (New York: Springer, 1983), 352–357; J. Tester, *A History of Western Astrology*, 23.

8 M.J. Geller, *Look to the Stars: Babylonian medicine, magic, astrology and melothesia* (Preprint 401. Berlin: Max Planck Institute for the History of Science, 2010), 60–82. I thank Prof. Geller for sending this to me.

9 Manilius, *Astronomica* 2.457–465; 4.704–709 (Goold, LCL) (Hereafter, the Manilius tradition).

apparently rediscovered until the early fifteenth century.[10] The assigning of body parts to the planets, which, in turn, rule specific zodiac signs, is attested in Ptolemy's *Tetrabiblos*.[11]

The interaction between melothesia and a system of locating the position of the moon in the zodiac was necessary for surgery, such as the medieval practice of bleeding a certain part of the body (phlebotomy), to balance the four humours (phlegm, blood, black bile, yellow bile).[12] It was essential to know the position of the moon in the zodiac because, astrologically, it was thought to be dangerous to operate when the moon was in the zodiac sign that governed the body due to undergo lesion.[13] Different methods for finding the moon's zodiacal position are borne out: for example, almanacs,[14] the astrolabe,[15] or a volvelle, a circular device with the calendar on the outside and inner wheels showing the lunar and solar zodiacs on the inside.[16]

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10 K. Volk, *Manilius and his Intellectual Background* (Oxford: OUP, 2009), 1–2.

11 Ptolemy, *Tetrabiblos* 1.17, 3.12.147–148 (Robbins, LCL) (Hereafter, the Ptolemy tradition).

12 S. Page, *Astrology in Medieval Manuscripts* (London: The British Library, 2002), 54; J. Tester, A *History of Western Astrology*, 61. Bloodletting was a treatment for an excess of blood. Galen implemented this system of treatment based on the Hippocratic theory of the four humours, see Ian M. Lonie, *The Hippocratic Treatises* (Berlin: De Gruyter, 1981), 54–62; Campion, *A History of Western Astrology*, 146–147.

13 Page, *Astrology*, 54; I. Taavitsainen, *Middle English Lunaries* (Mémoires de la Société Néophilologique 47; Helsinki: Société Néophilologique, 1988), 109; S. Sela, *Abraham Ibn Ezra on Elections, Interrogations, and Medical Astrology: A Parallel Hebrew-English Critical of the Book of Elections* (*3 versions*), *the Book of Interrogation* (*3 versions*) *and the Book of Luminaries* (Leiden: Brill, 2011), 55, 111–112, 199, 567 (The references against performing phlebotomy on a body part when the moon is in the zodiac sign that rules that part of the body are based on physiological astrology in Ptolemy's *Tetrabiblos*). For the preliminary publication, translation and study of three Hebrew manuscripts containing rules on phlebotomy, the calendar and the moon, see J. Isserles, "Hygiene and Dietary Calendars in Hebrew Manuscripts from Medieval Ashkenaz," in *Time, Astronomy and Calendars in the Jewish Tradition* (ed. S. Stern and C. Burnett; Leiden: Brill, 2014), 273–326 (esp. 275–276, 278–280, 285–290, 293–294, 298–303, 311). Justine Isserles sent this author an image of the illustrated Hebrew manuscript MS 5 fol. 116v, Paris, Alliance Israélite Universelle, containing a short text stating that one should let blood in relation to the stars, which is not reproduced in this chapter.

14 For example, British Library, IB. 32 (1475).

15 British Library ms: Add 47680, fol.53v: "A king consulting an astrologer and a physician" in Page, *Astrology*, 54, pl. 44, the astrologer appears to be holding an astrolabe.

16 Page, *Astrology*, 54–55, fig 45. British Library (BL) Egerton MS. 2572, fol.51. Parchment folio from the Guild-book of the Barber-Surgeons of York, *Circular zodiacal lunar chart* (c.1486).

During this time fine artistic representations of the generic image known as 'Zodiac Man,' a nude figure showing which body parts were assigned to particular zodiac signs, appeared in different European cultures, with and without an accompanying calendar.[17] Evidence of Jewish artistic participation in this tradition may be suggested by the illustration inscribed in Hebrew of a circumcised 'Zodiac Man' in the Bibliothèque Nationale de France (BnF) (Figure 6.2.1).[18] Here, the images and names of the signs of the zodiac are next to the respective physiological area that each sign governs. Stylised blood-red threads hang down from insertion points on the body parts, thereby denoting its medical purpose as a visual guide for bloodletting. It is also a work of art, beautifully executed, which is a characteristic feature of the genre. The symbolization of the zodiac signs in the Hebrew 'Zodiac Man' represents a similar tradition of zodiacal iconography found in the Beth Alpha synagogue, that of imagery that does not transgress Lev 19:19 (see §1.5): Sagittarius is represented by an archer, not a centaur, and the heads of unicorns replace the goat-fish, Capricorn.[19]

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17 For example, BL MS. 2572, fol. 50v, Guild-book of Barber-Surgeons of York [the days of the month are on the drawing; it accompanies the volvelle, fol. 51, above], *Zodiacal Man* (c.1486); University of Glasgow Library Special Collections, MS Hunter 251, fol. 47v, John of Arderne, *Mirror of Phlebotomy and Practice of Surgery* (1425–50); BL MS Sloane 2250, fol. 47v, *Physician's folding calendar* (1399); BL MS Sloane 2465, fol. 10, *14th century calendar*; National Library of Wales, MS 3026C, Gutun Owain MS, *Zodiac Man* (1488–1489); La Bibliothèque Nationale de France (BnF) MS Français 134, fol. 48v, Barthélemy l'Anglais, *de proprietatibus rerum*, trans. Jean Corbichon (late 15th century); BL Egerton 848, fol. 21, *Zodiac man* (c.1490); BL MS. Arundel 251, fol.46, *German medical miscellany* (c.1490); Johannes de Ketham, *Zodiac Man,* Fasculo Medicina (Venice: Gregori, 1493); *Les Très Riches Heures du Jean Duc de Berry*, Limbourg Brothers, MS. 65, Musée Condé, Chantilly, *Homo Signorum* (fol. 14v); (c.1413–1415); BL IB.32, *Zodiac man with a calendar* (1475); Wellcome Library, WMS 40, slide no. 8990 and MS. 40 *Astrological man from Medical Practitioner's Handbook, with calendrical information* (1463); BL 1141.a.37 (3), *Zodiac man*; Trinity College, Cambridge, John de Foxton, *Liber Cosmographie* (1408); Wellcome Library, bMS.54, Miscellanea Medica XVIII (early 14th century); Wellcome Library, *De Astrologia*, Gregor Reisch, *Margarita philosophica* (1503); Wellcome Library, "Man with viscera exposed and zodiac signs affecting them," *Horae beatissimae Mariae Virginis* (Paris, S Vostre, 1497); several medieval mss of the Zodiac man are shown on the website: A. Jokinen, "Zodiac Man: Man as Microcosm." Luminarium. Cited 26 August 2010. http://www.luminarium.org/encyclopedia/zodiacalman4.jpg.

18 BnF MS. Hébreu 1181, fol. 263. *Zodiacal Man: Mélanges de Médecine* (c.1450).

19 Cf. BL Egerton MS. 2527, fol. 50v, is similar in iconography and style; Capricorn is represented by a unicorn in a 14th century calendar cycle, NYC Morgan Library MS. M.511, fol. 6v, see O.K. Gordon, "Two Unusual Calendar Cycles of the Fourteenth Century," *Art Bulletin* 45.3 (1963), 245–253 (at 247, 249–250; fig. 12).

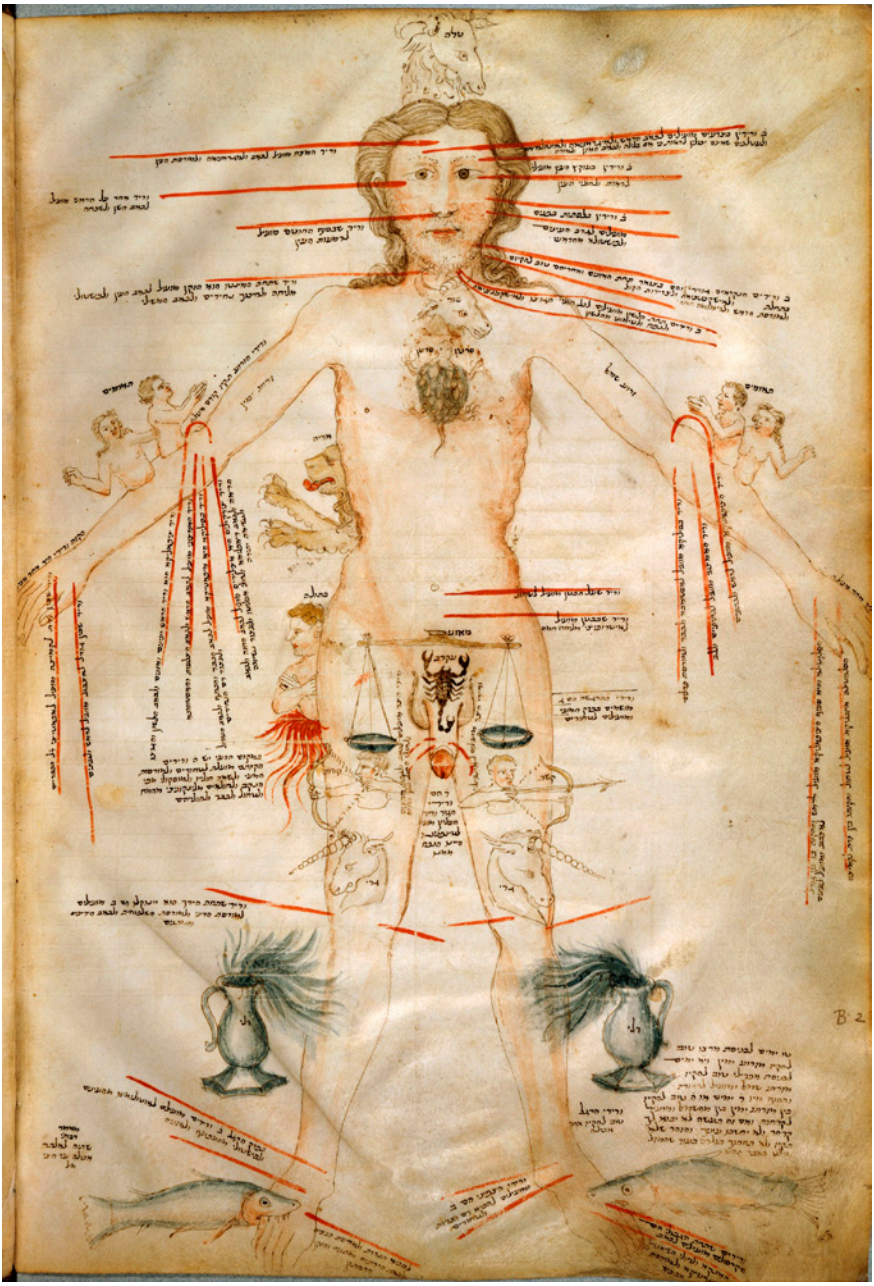

FIGURE 6.2.1 *Hebrew Zodiac Man with bloodletting points.*

It may be argued that Opp. 688, fol. 162v is an example of a combination astrological text in which a text from one tradition (that is, melothesia) has been amalgamated with a zodiac calendar, a construct from another tradition, in order to function. The combination of the two could be used, theoretically, as an all-in-one guide. In principle, the matrix of a lunar zodiac calendar with a melothesia scheme could enable a surgeon to calculate which dates he could, or should not, bleed a particular part of the body. However, the physiological list in the Bodleian table has too many errors in it to be of much use if the practitioner was not already familiar with the subject matter, as discussed later in this chapter. When one takes into account the possible European background of the Hebrew 'Zodiac man' of similar age it is evident that the melothesia component of Opp. 688, fol. 162v and its possible use for phlebotomy was not a unique feature of Jewish medicine at this time.

6.2.2 *Paleography of MS Opp. 688, fol. 162v*

The writing is a semi-cursive Ashkenazi, medieval script (Figure 6.2.3); it is quite similar to a manuscript of the kabbalistic work by Abraham ben Alexander of Cologne, *Keter Shem Tov*, copied in 1414.[20] The distinctive, *alef, bet, gimel, zayin*, in Opp. 688, fol. 162v are similar to those letters in the *Keter Shem Tov* manuscript. Interestingly, the *tet* at the start of the row of zodiac signs beginning with טלה, *Teleh,* Lamb/Aries, in Opp. 688, 'Zodiac Man' (row 16, col. 1), is similar to the specially written version of that letter in the *Keter Shem Tov* ms, fol. 8v (line 5).[21] There, the scribe has written the *tet* in the shape of a heart to denote its kabbalistic symbolism. The other *tets* in Opp. 688 fol. 162 including those representing *Teleh*, or the numeral 9,[22] within the table are written plainly. This particular orthographic statement may suggest that the copyist of Opp. 688, fol. 162 was familiar with the kabbalah. It could also imply that טלה, *Teleh* or the zodiac itself, embodied by Aries as the first sign, was esteemed.

The names of the signs of the zodiac (in row. 16) and the zodiac calendar table are almost error-free and are readable. In contrast, there are many scribal marks in the list of body parts (in row 17). On the whole these are messy and contain erasures. This noticeable difference in quality would imply that the copyist was familiar with the zodiac and the zodiac calendar, but not necessarily with the system of melothesia. The names of body parts also include some

20 BnF MS. Hebr. 773, fols. 1v–21r, in C. Sirat, *Hebrew Manuscripts of the Middle Ages* (ed. and trans. Nicholas de Lange; Cambridge: Cambridge University Press, 2002), 314–317; also the *alef*, in fig. 10, 172.

21 Sirat, *Hebrew Manuscripts*, 316.

22 *Tet* is the 9th letter of the Hebrew alphabet; letters and numerals are synonymous.

obscure terms and a possible loan word, spelled phonetically, discussed in the sub-section of the manuscript's 'Zodiac Man.'

The five lines of text beneath the table are hard to make sense of and do not appear to relate directly to the main table, if at all. Some of the words and letters are unclear and ambiguous.

6.2.3 *Description of Opp. 688 'Zodiac Calendar'*

This sub-section section will describe the lunar zodiac in the manuscript in order to give a sense of the presentation of the information.[23] The schematic calendar in Opp. 688, fol. 162v is neatly arranged in a tabular grid consisting of 14 columns, right to left, and the first 15 rows. The ordinal numbers of the days of the month (cols. 1–13, rows 1–3) are at the top of the table. The first letters of the zodiac signs denoting the moon's zodiacal position for 360 days are plotted in the main body (cols. 1–13, rows 4–15), beginning with Aries (*tet* for *Teleh*, טלה) on Nisan 1. The 12 months of the year, the Aramaic-Babylonian month names attested in 4Q318 and known from the Hebrew calendar,[24] are listed vertically, beginning with Nisan (col. 14, lines 4 to 15).

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23 A similar schematic table is published in J. Isserles and S. Stern, "The Astrological and Calendar Section of the Earliest Maḥzor Vitry Manuscript (MS ex-Sassoon 535)," *Aleph* (forthcoming), at 451–453. The table in MS ex-Sassoon 535 is a 360-day lunar zodiac calendar describing the moon's journey through 13 zodiac signs each month, hence a synodic month, in a strange arrangement of two and three days per sign an apparent logical astronomical pattern. The arrangement for the moon's stay of two and three days in each sign per month is as follows: 2 days-2 days-3 days-2 days-2 days-2 days-2 days-3 days-3 days-2 days-2 days-3 days-2 days. Another Hebrew zodiac table is referenced in note 25: fol. 121r of the Hamburg Miscellany, Cod. Hebr 37, Hamburg Staats-und Universität Bibliothek. This small zodiac calendar written in red ink in neat square script, the days of thje month are written in black in in semi-cursive script. The lay-out of the Hamburg Miscellany zodiac calendar is identical to that of Opp. 688, fol. 162v without the two bottom rows of the melothesia table and the signs of the zodiac. Like Opp. 688, fol. 162v the Hamburg Miscellany 360-day calendar has the 30 days of the 12 months written in the top two rows. The days are grouped together in the same numerical way in a 2 day, 2 day, 3 day formulaic pattern: 1, 2;/ 3, 4;/ 5, 6, 7;/ 8, 9;/ 10, 11;/ 12, 13, 14;/ 15, 16; / 17, 18;/ 19, 20, 21;/ 22, 23;/ 24, 25/ 26, 27, 28;/ 29, 30. The signs of the zodiac, beginning with Aries on Nisan 1 are also indicated by the first letter of the name of each zodiac sign. The table was written in 1434 and is part of a calendrical section of the miscellany, see Zsófia Buda, "Sacrifice and Redemption in the Hamburg Miscellany: The Illustrations of a Fifteenth-Century Ashkenaz Manuscript." (Ph.D. diss., Medieval Studies, Central European University, Budapest, 2012), 14, 18.

24 According to S. Stern, the Hebrew calendar reached its present form by the ninth and tenth centuries, see S. Stern, *Calendar and Community*, 191–210.

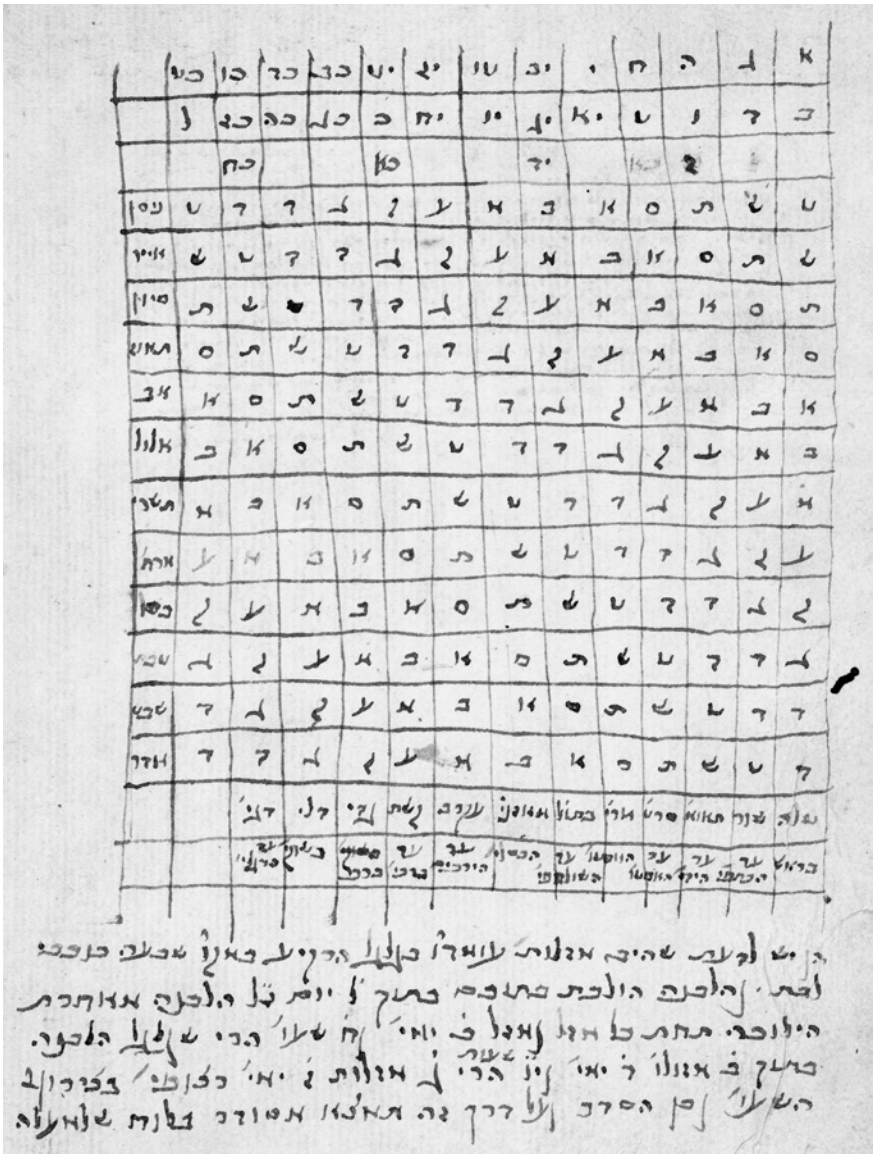

FIGURE 6.2.3 *MS Opp. 688 fol. 162v. 'Zodiac Calendar and Melothesia'.*

The position of the moon in the zodiac on a given date may be located by looking down the columns listing the days in ordinal numbers, and across the rows of month names to the date (day and month) in question. Unlike *4QZodiac Calendar*, Opp. 688 'Zodiac Calendar' begins with the moon in Aries, not in Taurus.

6.2.3.1 Days of the Month

The 30 days of the month are arranged in a two-and three-day scheme in rows 1–3. Each pair of numerals, or group of three days is read from top to bottom.

Days 1 and 2: *alef* א and *bet* ב, are in the first column on the right (col. 1, in rows 1 and 2, respectively. **Days 3 and 4**: *gimel* ג and *dalet* ד, are in col. 2, rows 1 and 2 respectively. **Days 5, 6 and 7**: *he* ה, *vav* ו, *zayin* ז, occupy col. 3, rows, 1, 2 and 3 respectively.

This arrangement continues until column 13. The 13th column contains days 29 and 30: כט *kaf-tet* and ל *lamed*, respectively. The two-and-three-day schematic arrangement of the moon's daily journey through the zodiac each month, therefore, runs as follows: 2 days, 2 days, 3 days, 2 days, 2 days, 3 days, 2 days, 2 days, 3 days, 2 days, 2 days, 3 days, 2 days. In other words, the moon is placed in a zodiac signs for two days and three days at a time over 30 days every month, according to this particular scheme. The arrangement, therefore, is the same as *4QZodiac Calendar*, except that it begins in Aries not Taurus.

6.2.3.2 Days of the Year

There are 156 cells in the grid formed by the columns of the ordinal days of the month (cols 1–13) and the rows of Aramaic-Babylonian month names (column 14), each containing the first letter of a sign of the Hebrew zodiac. These letters represent the moon's zodiacal position on those days. The signs of the zodiac on days 29 and 30 (row 4, col. 13) are the same as those for days 1 and 2; the months represented are, therefore, synodic. Having described the grid of the zodiac calendar, I shall now examine the two additional rows, lines 16 and 17, which represent the information on melothesia or 'Zodiac Man.'

6.3 MS. Opp. 688 'Zodiac Calendar' Compared

This section will now compare the data in MS. Opp. 688. 'Zodiac Calendar' with *4QZodiac Calendar* and the 'Dodekatemoria scheme.' This may ascertain if the texts are related. In Table 6.3a, MS. Opp. 688 'Zodiac Calendar' is translated into English with Arabic numerals, and the traditional zodiacal glyphs. I have included the transcription of the zodiac signs (Table 6.3a, row 16) because they are a key to the zodiac symbols in the grid, represented by the first Hebrew letter of each sign name (see Fig. 6.3.2), as well as being used for the melothesia table discussed in the next section.

The scribe's method of presenting this schematic astronomical information is very clear. The days of the month in the top three rows show that on every

TABLE 6.3a *MS Opp. 688, fol. 162v 'Zodiac Calendar'*

	29	26	24	22	19	17	15	12	10	8	5	3	1
	30	26	25	23	20	18	16	13	11	9	6	4	2
		28			21			14			7		
Nisan	♈	♓	♒	♑	♐	♏	♎	♍	♌	♋	♊	♉	♈
Iyar	♉	♈	♓	♒	♑	♐	♏	♎	♍	♌	♋	♊	♉
Sivan	♊	♉	♈	♓	♒	♑	♐	♏	♎	♍	♌	♋	♊
Tammuz	♋	♊	♉	♈	♓	♒	♑	♐	♏	♎	♍	♌	♋
Av	♌	♋	♊	♉	♈	♓	♒	♑	♐	♏	♎	♍	♌
Elul	♍	♌	♋	♊	♉	♈	♓	♒	♑	♐	♏	♎	♍
Tishri	♎	♍	♌	♋	♊	♉	♈	♓	♒	♑	♐	♏	♎
Marh'	♏	♎	♍	♌	♋	♊	♉	♈	♓	♒	♑	♐	♏
Kislev	♐	♏	♎	♍	♌	♋	♊	♉	♈	♓	♒	♑	♐
Tevet	♑	♐	♏	♎	♍	♌	♋	♊	♉	♈	♓	♒	♑
Shevat	♒	♑	♐	♏	♎	♍	♌	♋	♊	♉	♈	♓	♒
Adar	♓	♒	♑	♐	♏	♎	♍	♌	♋	♊	♉	♈	♓
		Pi	Aq	Cap	Sag	Sc	Lib	Vir	Leo	Can	Gem	Tau	Ar

Key: Aries ♈; Taurus ♉; Gemini ♊; Cancer ♋; Leo ♌; Virgo ♍; Libra ♎; Scorpio ♏; Sagittarius ♐; Capricorn ♑; Aquarius ♒; Pisces ♓

seventh day the moon is in the last day of a schematic group of 3 days (a triad) in the 2-2-3 day arrangement. An identical pattern appears in *4QZodiac Calendar*. I have revised Opp 688. 'Zodiac Calendar,' with the addition of hypothetical degrees for comparison purposes (see Table 6.3b, far right, col. 1).

When the degrees are added, it is again clear how difficult it is to read the grid without understanding that the moon has already changed signs on the third day of its journey through that same sign. The problem is shown in the additional column of Table 6.3b.It may be seen with this arrangement that on the 7th, 14th, 21st, and 28th of every month the moon has already entered the next sign in one-degree progressive increments, beginning at 1°. On day 7, the moon is at 1° of a sign; on day 14, the moon is at 2° and so on. The zodiac sign that the moon has already left is the one that appears in the table in the month column for that day, but the degree refers to the sign shown in the month column for the next day. A similar table to the Hebrew scheme is shown for *4QZodiac Calendar* (Table 6.3c).

TABLE 6.3b *MS Opp. 688 'Zodiac Calendar' with schematic degrees highlighting every 7th day*

	Nisan	Iyyar	Sivan	Tam'	Av	Elul	Tishri	Marh'	Kisl'	Tevet	She'	Adar	
1	♈	♉	♊	♋	♌	♍	♎	♏	♐	♑	♒	♓	13°
2	♈	♉	♊	♋	♌	♍	♎	♏	♐	♑	♒	♓	26°
3	♉	♊	♋	♌	♍	♎	♏	♐	♑	♒	♓	♈	9°
4	♉	♊	♋	♌	♍	♎	♏	♐	♑	♒	♓	♈	22°
5	♊	♋	♌	♍	♎	♏	♐	♑	♒	♓	♈	♉	5°
6	♊	♋	♌	♍	♎	♏	♐	♑	♒	♓	♈	♉	18°
7	♊	♋	♌	♍	♎	♏	♐	♑	♒	♓	♈	♉	1°
8	♋	♌	♍	♎	♏	♐	♑	♒	♓	♈	♉	♊	14°
9	♋	♌	♍	♎	♏	♐	♑	♒	♓	♈	♉	♊	27°
10	♌	♍	♎	♏	♐	♑	♒	♓	♈	♉	♊	♋	10°
11	♌	♍	♎	♏	♐	♑	♒	♓	♈	♉	♊	♋	23°
12	♍	♎	♏	♐	♑	♒	♓	♈	♉	♊	♋	♌	6°
13	♍	♎	♏	♐	♑	♒	♓	♈	♉	♊	♋	♌	19°
14	♍	♎	♏	♐	♑	♒	♓	♈	♉	♊	♋	♌	2°
15	♎	♏	♐	♑	♒	♓	♈	♉	♊	♋	♌	♍	15°
16	♎	♏	♐	♑	♒	♓	♈	♉	♊	♋	♌	♍	28°
17	♏	♐	♑	♒	♓	♈	♉	♊	♋	♌	♍	♎	11°
18	♏	♐	♑	♒	♓	♈	♉	♊	♋	♌	♍	♎	24°
19	♐	♑	♒	♓	♈	♉	♊	♋	♌	♍	♎	♏	7°
20	♐	♑	♒	♓	♈	♉	♊	♋	♌	♍	♎	♏	20°
21	♐	♑	♒	♓	♈	♉	♊	♋	♌	♍	♎	♏	3°
22	♑	♒	♓	♈	♉	♊	♋	♌	♍	♎	♏	♐	16°
23	♑	♒	♓	♈	♉	♊	♋	♌	♍	♎	♏	♐	29°
24	♒	♓	♈	♉	♊	♋	♌	♍	♎	♏	♐	♑	12°
25	♒	♓	♈	♉	♊	♋	♌	♍	♎	♏	♐	♑	25°
26	♓	♈	♉	♊	♋	♌	♍	♎	♏	♐	♑	♒	8°
27	♓	♈	♉	♊	♋	♌	♍	♎	♏	♐	♑	♒	21°
28	♓	♈	♉	♊	♋	♌	♍	♎	♏	♐	♑	♒	4°
29	♈	♉	♊	♋	♌	♍	♎	♏	♐	♑	♒	♓	17°
30	♈	♉	♊	♋	♌	♍	♎	♏	♐	♑	♒	♓	30°

Key: Aries ♈; Taurus ♉; Gemini ♊; Cancer ♋; Leo ♌; Virgo ♍; Libra ♎; Scorpio ♏; Sagittarius ♐; Capricorn ♑; Aquarius ♒; Pisces ♓

TABLE 6.3C *4Q318* 'Zodiac Calendar' *with schematic degrees highlighting every 7th day*

	Nisan	Iyyar	Sivan	Tam'	Av	Elul	Tishri	Hesh'	Kislev	Tevet	Shevat	Adar	
1	♉	♊	♋	♌	♍	♎	♏	♐	♑	♒	♓	♈	13°
2	♉	♊	♋	♌	♍	♎	♏	♐	♑	♒	♓	♈	26°
3	♊	♋	♌	♍	♎	♏	♐	♑	♒	♓	♈	♉	9°
4	♊	♋	♌	♍	♎	♏	♐	♑	♒	♓	♈	♉	22°
5	♋	♌	♍	♎	♏	♐	♑	♒	♓	♈	♉	♊	5°
6	♋	♌	♍	♎	♏	♐	♑	♒	♓	♈	♉	♊	18°
7	♋	♌	♍	♎	♏	♐	♑	♒	♓	♈	♉	♊	**1°**
8	♌	♍	♎	♏	♐	♑	♒	♓	♈	♉	♊	♋	14°
9	♌	♍	♎	♏	♐	♑	♒	♓	♈	♉	♊	♋	27°
10	♍	♎	♏	♐	♑	♒	♓	♈	♉	♊	♋	♌	10°
11	♍	♎	♏	♐	♑	♒	♓	♈	♉	♊	♋	♌	23°
12	♎	♏	♐	♑	♒	♓	♈	♉	♊	♋	♌	♍	6°
13	♎	♏	♐	♑	♒	♓	♈	♉	♊	♋	♌	♍	19°
14	♎	♏	♐	♑	♒	♓	♈	♉	♊	♋	♌	♍	**2°**
15	♏	♐	♑	♒	♓	♈	♉	♊	♋	♌	♍	♎	15°
16	♏	♐	♑	♒	♓	♈	♉	♊	♋	♌	♍	♎	28°
17	♐	♑	♒	♓	♈	♉	♊	♋	♌	♍	♎	♏	11°
18	♐	♑	♒	♓	♈	♉	♊	♋	♌	♍	♎	♏	24°
19	♑	♒	♓	♈	♉	♊	♋	♌	♍	♎	♏	♐	7°
20	♑	♒	♓	♈	♉	♊	♋	♌	♍	♎	♏	♐	20°
21	♑	♒	♓	♈	♉	♊	♋	♌	♍	♎	♏	♐	**3°**
22	♒	♓	♈	♉	♊	♋	♌	♍	♎	♏	♐	♑	16°
23	♒	♓	♈	♉	♊	♋	♌	♍	♎	♏	♐	♑	29°
24	♓	♈	♉	♊	♋	♌	♍	♎	♏	♐	♑	♒	12°
25	♓	♈	♉	♊	♋	♌	♍	♎	♏	♐	♑	♒	25°
26	♈	♉	♊	♋	♌	♍	♎	♏	♐	♑	♒	♓	8°
27	♈	♉	♊	♋	♌	♍	♎	♏	♐	♑	♒	♓	21°
28	♈	♉	♊	♋	♌	♍	♎	♏	♐	♑	♒	♓	**4°**
29	♉	♊	♋	♌	♍	♎	♏	♐	♑	♒	♓	♈	17°
30	♉	♊	♋	♌	♍	♎	♏	♐	♑	♒	♓	♈	30°

Key: Aries ♈; Taurus ♉; Gemini ♊; Cancer ♋; Leo ♌; Virgo ♍; Libra ♎; Scorpio ♏; Sagittarius ♐; Capricorn ♑; Aquarius ♒; Pisces ♓

If *4QZodiac Calendar*, theoretically, ran on continually from Opp. 688 in a scheme of 360-day years, or vice versa, the same pattern could recur every 7th day: day 5, is at 5° of a new sign, day 12 is at 6° of a new sign, day 19 is at 7° of a new sign and day 26 is at 8° of a new sign. The idea that moon does not change sign on the Sabbath (cf. Gen 2:2–3) was suggested by Michael Wise in relation to 4Q318, although he had reconstructed *4QZodiac Calendar* according to a 364-day year with four additional days between the seasons.[25] The 360-day calendar does not have a fixed Sabbath that would fall on the same day of the week; however, the principal of Wise's theory, that the moon does not change sign every 7th day applies mathematically to these tables when degrees are added in daily increments of 13° and run on continuously.

The 'Dodekatemoria scheme' (with numerical months) is so arranged that the 7th day in the 360-day year falls on the first degree of a sign (see Table 6.3d). The first degree and the recurring incremental pattern take place on the first day of the triad. The 'Dodekatemoria scheme' is reproduced again, below, with those degrees highlighted.

TABLE 6.3d *The 'Dodekatemoria scheme' with schematic degrees highlighting every 7th day*

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
1	♈	♉	♊	♋	♌	♍	♎	♏	♐	♑	♒	♓	13°
2	♈	♉	♊	♋	♌	♍	♎	♏	♐	♑	♒	♓	26°
3	♉	♊	♋	♌	♍	♎	♏	♐	♑	♒	♓	♈	9°
4	♉	♊	♋	♌	♍	♎	♏	♐	♑	♒	♓	♈	22°
5	♊	♋	♌	♍	♎	♏	♐	♑	♒	♓	♈	♉	5°
6	♊	♋	♌	♍	♎	♏	♐	♑	♒	♓	♈	♉	18°
7	♋	♌	♍	♎	♏	♐	♑	♒	♓	♈	♉	♊	**1°**
8	♋	♌	♍	♎	♏	♐	♑	♒	♓	♈	♉	♊	14°
9	♋	♌	♍	♎	♏	♐	♑	♒	♓	♈	♉	♊	27°
10	♌	♍	♎	♏	♐	♑	♒	♓	♈	♉	♊	♋	10°
11	♌	♍	♎	♏	♐	♑	♒	♓	♈	♉	♊	♋	23°
12	♍	♎	♏	♐	♑	♒	♓	♈	♉	♊	♋	♌	6°
13	♍	♎	♏	♐	♑	♒	♓	♈	♉	♊	♋	♌	19°
14	♎	♏	♐	♑	♒	♓	♈	♉	♊	♋	♌	♍	**2°**
15	♎	♏	♐	♑	♒	♓	♈	♉	♊	♋	♌	♍	15°
16	♎	♏	♐	♑	♒	♓	♈	♉	♊	♋	♌	♍	28°

25 Wise, *Thunder in Gemini*, 20–21, 38.

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
17	♏	♐	♑	♒	♓	♈	♉	♊	♋	♌	♍	♎	11°
18	♏	♐	♑	♒	♓	♈	♉	♊	♋	♌	♍	♎	24°
19	♐	♑	♒	♓	♈	♉	♊	♋	♌	♍	♎	♏	7°
20	♐	♑	♒	♓	♈	♉	♊	♋	♌	♍	♎	♏	20°
21	♑	♒	♓	♈	♉	♊	♋	♌	♍	♎	♏	♐	**3°**
22	♑	♒	♓	♈	♉	♊	♋	♌	♍	♎	♏	♐	16°
23	♑	♒	♓	♈	♉	♊	♋	♌	♍	♎	♏	♐	29°
24	♒	♓	♈	♉	♊	♋	♌	♍	♎	♏	♐	♑	12°
25	♒	♓	♈	♉	♊	♋	♌	♍	♎	♏	♐	♑	25°
26	♓	♈	♉	♊	♋	♌	♍	♎	♏	♐	♑	♒	8°
27	♓	♈	♉	♊	♋	♌	♍	♎	♏	♐	♑	♒	21°
28	♈	♉	♊	♋	♌	♍	♎	♏	♐	♑	♒	♓	**4°**
29	♈	♉	♊	♋	♌	♍	♎	♏	♐	♑	♒	♓	17°
30	♈	♉	♊	♋	♌	♍	♎	♏	♐	♑	♒	♓	30°

Key: Aries ♈; Taurus ♉; Gemini ♊; Cancer ♋; Leo ♌; Virgo ♍; Libra ♎; Scorpio ♏; Sagittarius ♐; Capricorn ♑; Aquarius ♒; Pisces ♓

It is possible that Opp. 688 'Zodiac Calendar' may originally have been part of the same tradition as the 4Q318 calendar, which, in turn, may be part of an elegant mathematical tradition that differs from the late Babylonian micro-zodiac system and has an affinity with the Babylonian 'Dodekatemoria scheme.' However, neither the Qumran nor the late medieval Hebrew zodiac calendar have degrees, which means that, in practice, they would probably not have been used with their secondary texts with great precision. These ideas will be considered in the next level of this sub-section.

6.3.1 *Opp. 688 'Zodiac Calendar' in Relation to Babylonian Horoscopes*

The lunar data in Opp. 688 'Zodiac Calendar' will be here compared to data in 18 Babylonian horoscopes[26] by examining the dates and moon signs in both the medieval text and the Mesopotamian corpus. The purpose of comparing data from the Opp. 688 'Zodiac Calendar' is to be able to consider the relationship between the Hebrew zodiac calendar and any possible ancient antecedents, or contemporaneous Byzantine Greek astrological texts. The results from the

26 Rochberg, *Babylonian Horoscopes,* text numbers: 5, 8, 9, 10, 12, 13, 14, 15, 16a, 16b, 17, 18, 19, 20, 21, 23, 26, 29.

study in Chapter 1 on *4QZodiac Calendar* in relation to the lunar data from *Babylonian Horoscopes* [abbrev. *BH*] (in Table 1.4.2a, see Chapter 1) have been included in the table below (see Table 6.3.1).[27]

TABLE 6.3.1 *Data in the* Babylonian Horoscopes *compared to Opp. 688 'Zodiac Calendar' and* 4QZodiac Calendar

BH	Text date	Text sign	Opp. 688	4Q318
5	23?/XII	"10° Aquarius"		29° Cap–12° Aq
8	8/IX	27° Pisces {C}	14°–27° Pisces*	
9	2/X	"12° Aquarius"	26° Cap–9°Aq*	
10	4/III	6° Leo {C}	22° Can–5° Leo*	
12	28/III	2° Cancer {C}		4°–17° Cancer
13	4/V	0° Libra {C}	22° Vir–5° Lib*	
14	12/VII	8° Aries {C}		6°–19° Aries
15	9/XI	27° Taurus {C}	27° Tau–10° Gem*	
16a	3/III	"15° Cancer"	9°–22° Cancer*	
16b	14/VII	18° Taurus {C}		2°–15° Taurus
17	(19?)/VII	14° Gemini {C}	7°–20° Gemini*	
18	6/XII	3° Gemini {C}	18° Tau–1° Gem*	
19	13/VI	3° Pisces {C}	19° Aq–2° Pisces*	
20	24/V	25° Gemini {C}	12°–25° Gemini*	
21	22/VI	0° Leo {C}		16°–29° Cancer
23	9/X	"5° Taurus"	27° Ar–10° Tau*	
26	25/V	"8° Leo"		25° Can–8° Leo
27	20/I	"18° Cap"		20° Cap–3° Aq

Columns 4 and 5 show the moon's position on the *BH* texts' dates (cols. 1–3) for the Opp. 688 and 4Q318 zodiac calendar paradigms.
*Correlations with the 'Dodekatemoria scheme' (Table 6.3d)

27 The data are reproduced in cols. 1–3: col. 1: Text number; col. 2: date of text; col. 3: the position of the moon as given in the text. Where the ancient astrologer has not provided the exact degree, the computation by Rochberg has been used instead, represented by a capital C in curly brackets {C}.

The results for Opp. 688, 'Zodiac Calendar' were the same as those for the 'Dodekatemoria scheme' (indicated by an asterisk). The similarity between the contents of the table in MS. Opp. 688 "Zodiac Calendar" and the Babylonian 'Dodekatemoria scheme' may be due to the fact that both texts begin with the moon in Aries on Nisan 1, 2, rather than in Taurus, even though the lunar zodiac pattern between MS. Opp. 688 'Zodiac Calendar' and *4QZodiac Calendar* is the same. As 4Q318 is a sign ahead of MS. Opp. 688 'Zodiac Calendar' it would appear that if they were used at all as self-contained years, they could correspond to different ideal years in a cycle. Although the 'Dodekatemoria scheme' has degrees and MS. Opp. 688, 'Zodiac Calendar' and *4QZodiac Calendar* do not; they are are all mathematically contiguous.

6.4 Opp. 688 'Zodiac Man'

The fully written signs of the zodiac (row 16) run across 12 columns (cols. 1 to 12) from right to left (Figure 6.2.3). Directly beneath each sign is a part of the body with which each has been paired (row 17). This subsection will note the orthographic details and content, and highlight some of the problems of identification in row 17, the physiological components (summary chart, Table 6.4.1).

Col. 1, Rows 16–17

טלה(*Lamb/ Aries*): בראש (*In the head*). As stated, the *tet* is written in the kabbalistic style. The writing in both cells is clear and correct. Aries, the starting point of the zodiac, rules the head, the first part of the body in the Manilius tradition.[28] All the illustrated manuscripts that I have seen,[29] except BnF MS. Hébreu 1181, fol. 263,[30] follow the representation of Aries as a ram. The Hebrew Zodiac Man, MS. Hébreu, has an image of a lamb upon his head, with the inscription, טלה, *Lamb/ Aries*, on its forehead (Fig. 6.2.1).

Col. 2, Rows 16–17

שור (*Ox/Taurus*): עד הכתפי' (*until the shoulders*{?}). There is a supralinear abbreviation mark after the *yod*, probably signifying the absence of the final *mem*. The plural of כתף (n.f) should be the dual masculine ending for nouns

28 Manilius, *Astronomica* 2.457; 4.704–709 (Goold, LCL). Not in Ptolemy's *Tetrabiblos*.

29 All references to viewed "Zodiac man" mss are cited throughout this chapter, according to body parts.

30 See also, Isserles, "Dietary Calendars," 286 n. 69, for further bibliographic details.

counted in pairs, thus כתפים, although this is unattested,[31] and it is sometimes assumed to be כתפת.[32] The letter next to *tav* looks like a *ḥet* with a long bottom horizontal line, as if extending from the left leg of the *tav*, so that it could read: (?)הכתחי but this is meaningless. The word intrudes into col. 3. Taurus does not rule the shoulders in the astrological tradition, but the neck.[33] One would expect to read *neck* ערף or צואר; or *throat* גרון, but the orthography does not permit this reading.

The preposition "until," may be a reference to the influence of the previous zodiac sign up to border of the next body part. It is possible that the information was taken visually from an image of a Zodiac man as several representations have a bull across the back of the neck, on the shoulders.[34]

Col. 3, Rows 16–17

תאומ׳ (*Twins/ Gemini*): עד הידי׳ (*until the hands*). The final *mem* of ידים (n.f. pl. dual.) is abbreviated and the phrase slightly overlaps with col. 4. In the Manilius tradition Gemini rules the arms to the shoulders.[35] This is the case in all the medieval illustrations of Zodiac man that I observed. The hands may be part of the same tradition and understood as coming under the influence of Gemini. "Until the hands" from the shoulders would include the arms.

Col. 4, Rows 16–17

סרט׳ (*Crab/ Cancer*): עד האסטו׳ (*until the stomach/ between the organs/ heart muscle?*). The writing is not difficult to read, and the phrase, with its abbreviated ending, intrudes into col. 5. The meaning and etymology are of interest. It is a Talmudic loan word spelt in variable ways and may be from the Greek word, *stomachos*.[36] According to Sokoloff, איצטומכא means a tight opening

31 Joüon and Muraoka, *Grammar of Biblical Hebrew*, 251.

32 Clines, *Concise Dictionary of Classical Hebrew*, 186.

33 Manilius, *Astronomica* 2.456–7 (Goold, LCL); 4.704; not in Ptolemy.

34 For example, Folio 14v of *Les Très Riches Heures du Duc de Berry*, Limbourg Brothers, 1413–16; BL Egerton 2572, fol. 50v (1486); Johannes de Keham. Fasculo de Medicina (Venice: Gregori, 1493); BL 1141.a.37 (3); Trinity College, John de Foxton's *Liber Cosmologie Cosmographiae* (1408); Wellcome Library, MS.40 (1463); Glasgow MS. Hunter 251, fol. 47v; BnF MS. Français 134 fol. 48v; BL MS. Egerton 848 fol. 21; National Library of Wales MS. 3026C.

35 Manilius, *Astronomica* 2.458; 4.704–709. Not in Ptolemy's *Tetrabiblos*.

36 M. Sokoloff, *A Dictionary of Jewish Babylonian Aramaic* (Ramat Gan: Bar Ilan University Press, 2002), 121–122; M.J. Geller, "Review of Michael Sokoloff, *A Dictionary of Judean Aramaic*, Ramat Gan: Bar Ilan University Press, 2003; *A Dictionary of Jewish Babylonian Aramaic*, Ramat Gan: Bar Ilan University Press, 2002," in *The Gold and Silver Road of Trade*

between the internal organs; Geller argues that the word probably refers to the heart muscle.[37] In the Manilius tradition, Cancer rules the breast;[38] in Ptolemy's *Tetrabiblos*, the Moon rules taste and drinking, the stomach, belly and womb and all the left-hand parts[39] and the sign of Cancer.[40]

In the 'Zodiac man' of BnF MS Hébreu 1181, fol. 263v (date, 1450), the Crab is on the heart, as is the case with Egerton: on 2572 fol.50v (date, 1486). In *Très Riches* "Homo Signorum" 14v the crab is on the chest or heart and the lion is on the ribs. In contrast, Sloane MS 2250, fol.12 (date, 1399), which pre-dated the rediscovery of *Astronomica*, the crab is on the throat and collar bones, that is higher up, not lower down the body and the lion is on the heart and breast.

Cancer does not rule the stomach (an interpretation of Ptolemy's tradition) in any of the illustrated Zodiac man manuscripts. If Cancer rules the stomach in Opp. 688 "Zodiac Man," it would mean a departure from the descending order of the body parts according to the system of melothesia. Therefore, the heart and breast region would be a more logical translation and interpretation of האסטו׳; this would stay within the zodiacal order and the illustrated zodiac man manuscript traditions.

Col. 5, Rows 16–17

ארי׳ (*Lion/Leo*): האסטו׳ (*the stomach? heart?*) See above. The text overlaps with col. 6. The word עד is not repeated. It is a repetition of the previous body part and it has not been corrected. This duplication, possibly due to the copyist's eye going back to the same place, suggests that the scribe did not know this subject. In the *Tetrabiblos* tradition, the sun rules the heart and it is associated with Leo.[41] In the Manilius tradition, Leo rules the sides and shoulder blades.[42] The fact that illustrated manuscripts reflecting different traditions were being produced at this time—the heart or ribs/the sides—could be another reason for the duplication. Hence, due to the doubling of the same body part with Cancer, it is not known which tradition Opp. 688 'Zodiac Man' would have

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and Friendship (Edited by Volker Grabowsky and Andrew Turton; Chiang Mai: Silkworm Books, 2003), 301–304. Cited August 25 2010.Online: http://eprints.soas.ac.uk/7417/1/book_review_sumerian_grammar.pdf.

37 Sokoloff, *DJBA*, 121–122; Geller, Review of *DJBA*, 302–303.

38 Manilius, *Astronomica* 2.459, 4.705 (Goold, LCL).

39 Ptolemy, *Tetrabiblos* 3.12.148 (Robbins, LCL), 321.

40 Ptolemy, *Tetrabiblos* 1.17 (Robbins, LCL), 79; cf, Manilius, *Astronomica* 2.440 (Goold, LCL): Mercury rules Cancer.

41 Ptolemy, *Tetrabiblos* 1.17; 3.12.148 (Robbins, LCL), 79, 319.

42 Manilius, *Astronomica* 2.460, 4.706 (Goold, LCL), 219, 279.

preferred for Leo: the heart (the Ptolemy tradition),[43] or the sides (the Manilius tradition).[44] Leo does not rule the stomach in any attested tradition.

Col. 6, Rows 16–17

בתול׳ (*Maiden/ Virgo*): השולם פי׳ (*until the mouth of the Shulamite?*). The final letter of השולם, which would seem to be a final *mem* is against the grid line and פי׳ is in col 6, row 17, next to it, as if the words are in construct state. The meaning is obscure. The first noun may possibly be a shortened form of השולמית, the Shulamite young woman of Song 7. 1,1. This could be compatible with בתולה, Virgo. The Shulamite, then, would be a synonym for maiden. According Manilius, Virgo rules the groin and entrails, translated as "belly" by Goold.[45] In the *Tetrabiblos* tradition, Mercury, the ruler of Virgo governs speech and thought, the tongue, the bile, and the buttocks.[46] If פי׳, mouth or opening, is referring to the maiden's speech and mouth, the body parts would not be in descending zodiacal order. The alternative is that "the mouth of the Shulamite" is a euphemistic reference to a female body part, such as the opening to the womb. This solution would follow the position of the bodily zodiac sign order in the Manilius tradition.

In the illustrated manuscripts, Virgo is associated with the solar plexus region, in keeping with the zodiacal body order.[47] Representations of the sign also appear on the navel (the womb).[48] In the Hebrew "Zodiac man," Virgo appears in the lower back or buttocks, in the *Tetrabiblos* tradition.[49]

Col. 7, Rows 16–17

מאזני (*Scales/ Libra*): הכ?לי? (*the kidneys?*). The third root letter between the *kaf* and the *lamed* has been filled in, possibly as an erasure. There may be an abbreviated plural and a *yod* may be filled in as a dot after *lamed*. The final *tav*

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43 Leo in the heart region: BL IB.32 (1475); Ketham, 1494; BL 1141.a.37(a); de Foxton, 1408. The assignment of the sun to the heart (and thus, Leo) in Ptolemy's *Tetrabiblos* is attested in the woodcut of "Man with viscera exposed," *Horae beatissimae Mariae Virginis* (Paris: S Vostre, 1497), Wellcome Library, London.

44 Leo at the sides and ribs: BnF MS. Hébreu 1181, fol 263v (1450) and BL Egerton 2572, f.50v (1486) [as stated above]; and BL. MS. IB.32 (1475); Wellcome Library, Miscellanea Medica XVIII bMS.54 (early 14th century); Wellcome Library, Medical Practitioner's Handbook, MS.40 (1463); *Très Riches*, "Homo Signorum," fol. 14v (1413–16).

45 Manilius, *Astronomica* 2. 461, 4. 706 (Goold, LCL).

46 Ptolemy, *Tetrabiblos* 3.12 (Robbins, LCL), 321.

47 BL IB.32 (1475); WMS 40 (1463); *Très Riches*, fol. 14v, and others.

48 Barber Surgeons, 15th century, BL Egerton MS. 2572, fol. 50v.

49 Virgo is represented by a male-like figure by the buttocks in Hebrew zodiac man: BnF MS Hébreu 1181, fol. 263v (1450).

may be represented by the final abbreviation mark; hence, the word should read as הכליות "the kidneys." The word עד "until," is in the previous column. In the Manilius tradition, Libra governs the region of the loins[50] and according to Ptolemy, Venus, which governs Taurus and Libra[51] rules smell, the liver and the flesh.[52]

Col. 8, Rows 16–17

עקרב (*Scorpion/ Scorpio*): עד הירכים (*until the thighs*). The orthography here is clear. The final *mem* here is cursive. In the tradition of both Manilius and Ptolemy, Scorpio rules the reproductive organs: in *Tetrabiblos*, Mars, which rules Scorpio, is associated with the left ear, kidneys, veins as well as the genitals.[53] The thigh in Hebrew, singular, can also be used as a term for the seat of procreative power.[54] Therefore, if this is another euphemism, this entry may be correct.

Alternatively, if the thighs are not a euphemism but literal, the entry may be meant for the next sign, Sagittarius, which would be correct in all traditions of melothesia (see below). If so, either the body part for Libra, or Scorpio, which can rule the kidneys or the genitals, has been accidentally skipped by the copyist. Another view is that "until the thighs" literally includes the loins. In the illuminated manuscript tradition, Scorpio is associated, unanimously, with the reproductive organs.

Col. 9, Rows 16–17

קשת (*Archer/ Sagittarius*): עד ברכי' (*until the knees*). The orthography is clear. Sagittarius rules the thighs according to the zodiacal tradition known from Manilius,[55] not the knees, which are governed by Capricorn (see below). "Until the knees" may literally mean the thighs. If not, the zodiacal order here is one body part forwards out of line. This possible scribal error would again suggest that that the copyist was not familiar with this material. It is a question of interpreting what the scribe meant. In the *Tetrabiblos* tradition, Jupiter, which rules Sagittarius,[56] is "lord" of touch, the lungs, arteries and semen.[57]

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50 Manilius, *Astronomica* 2. 462; 4. 707 (Goold, LCL).

51 Ptolemy, *Tetrabiblos* 1. 17. 38 (Robbins, LCL).

52 Ptolemy, *Tetrabiblos* 3. 12. 148 (Robbins, LCL).

53 Manilius, *Astronomica* 2. 463, 4.707 (Goold, LCL); Ptolemy, *Tetrabiblos* 1. 17. 38; 3. 12. 148–9 (Robbins, LCL), 81, 319.

54 BDB, sv ירך, 438.

55 Manilius, *Astronomica* 2.463; 4.708 (Goold, LCL); not in Ptolemy, *Tetrabiblos*.

56 Ptolemy, *Tetrabiblos* 1.17 (Robbins, LCL), 81.

57 Ptolemy, *Tetrabiblos* 3. 148 (Robbins, LCL), 319.

Col. 10, Rows 16–17

גדי (*Kid-goat/ Capricorn*): ברכי׳ (*the knees*). This may be a duplicate from the sign before and it is the correct physical part. Since the word "until" is missing, the scribe simply may not have minded repeating the names of body parts so long as they were prefixed by either "until" or, "in." In the Manilius tradition, Capricorn rules the knees, and in *Tetrabiblos*, Saturn, which governs Capricorn, rules the bones.[58] The scribe had originally written the body part for the next sign, בשוקי׳ (*in the calves*), erased it and written the correct part, ברכי׳ (*the knees*) beneath it. The leg of the *qof* from the erased word above intrudes in ברכי׳, so that at first glance ברכי׳ appears to end in a *lamed*. It is the largest and most prominent erasure in the manuscript and it may show that the copyist had possibly become confused.

Col. 11, Rows 16–17

דלי (*Bucket/ Aquarius*): בשוקי׳ (*in the calves*).[59] The עד (until) is missing but the word is clear and the body part is correct. Aquarius rules the calves in the Manilius tradition;[60] this is the case in all the related illuminated manuscripts. The writing is rather untidy, or squashed in the space.

Col. 12, Rows 16–17

דגי׳ (*Fishes/ Pisces*): עד ברגלי׳ (*until in the feet*). There is overwriting both in the *dalet, bet* and *lamed*. The *lamed* crosses over the *gimel* and the word looks untidy, but the body part cannot be disputed. Pisces rules the feet in the Manilius tradition[61] and in all the Zodiac man illuminated manuscripts. The two prefixes "until" and "in" may suggest that Pisces rules the area between the calves and the feet (the ankles) as well as the feet.

6.4.1 *Summary of Opp. 688 'Zodiac Man'*

In general, MS. Opp. 688 'Zodiac Man' and the illuminated manuscripts discussed above agree with the arrangement of the body parts in the Manilius tradition of melothesia, that is, from head to toe, corresponding one-to-one with the zodiac signs from Aries (head) to Pisces (feet). Ptolemy's *Tetrabiblos* does not assign physiological elements in a zodiacally ordered head to toe arrangement. The findings showing the four traditions: Manilius, Ptolemy,

58 Manilius, *Astronomica* 2. 463, 4.708 (Goold, LCL); Ptolemy, *Tetrabiblos* 1.17. 34–5; 3. 12. 148 (Robbins, LCL), 81, 319.

59 *BDB*, 1003, sv. שׁוֹק.

60 Manilius, *Astronomica* 2. 464; 4. 709 (Goold, LCL); not in Ptolemy, *Tetrabiblos*.

61 Manilius, *Astronomica* 2. 465; 4. 709 (Goold, LCL); not in Ptolemy, *Tetrabiblos*.

medieval illustrations and Opp. 688, fol. 162v are listed in the Melothesia Table (Table: 6.4.1).

The comparison between the sources also showed that illuminated manuscripts were divided between the tradition described in Manilius's *Astronomica* and Ptolemy's *Tetrabiblos* with respect to the body parts ruled by Leo. In Opp. 688, 'Zodiac man' the body parts for Cancer and Leo were duplicated with an ambiguous word, which could mean either stomach (Cancer: Ptolemy) or heart (Leo: Ptolemy). The anatomical associations for Sagittarius and Capricorn, the thighs, were also duplicated (Sagittarius: Manilius). The scribe may not have minded repeating the names of body parts if he clarified the anatomical references with the prefixes of "until" and/or "in the." Alternatively, the duplications are scribal errors.

Aside from the problem of Cancer and Leo, Opp. 688 'Zodiac Man' adhered to the descending order of zodiac signs with assigned body parts, as described by Manilius. It is difficult to know whether the variants for the body parts for Virgo, and possibly Taurus and Gemini (unless "until" is taken into account), are significant because I do not know of any alternative attestations. The system of melothesia based on the Manilius tradition was popular in art and science in the late medieval period and pre-dated the apparent rediscovery of *Astronomica* itself. It is a possibility that the scribe of Opp. 688 'Zodiac Man' was not familiar with this concept, or that he was copying from a corrupt exemplar, or one that was in a different language, or he was being delicate with his vocabulary in some cases.

Since the system of melothesia was well known in European medical culture during this period, often combined with a calendar, and zodiac calendars existed in Byzantine esoterica (Chapter 2) there is no evidence to suggest that the sources for MS. Opp. 688 'Zodiac Man' were themselves ancient. Strangely, this combination Hebrew text does not seem to be part of mainstream Jewish culture, but apparently isolated.

The data in rows 16 and 17 cast some additional light on the extent of the knowledge of melothesia in certain sections of Jewish society. Due to the amount of errors, it is feasible that this manuscript may have been compiled and collected for medical interest, rather than for practical use. The melothesia system represented in rows 16 and 17 could have come originally from a separate source to the main zodiac calendar table. The corrections by the scribe, noticeably in row 17 could further suggest that the material was unfamiliar, or that the melothesia element was not part of the original exemplar of the calendar and that it was being written in, rather than copied. As far as I am aware, Opp. 688. 'Zodiac Man' is unusual or rare in using this particular zodiac table. I have not seen any other 360-day Hebrew lunar zodiac almanacs among the

TABLE 6.4.1 *Melothesia Table: Chart comparing Opp. 688 'Zodiac Man' with sources in Manilius, Ptolemy and illustrated manuscripts*

Zodiac sign	Manilius	Ptolemy	Illuminated mss	Opp. 688
Aries	Head	Mars: left ear, kidneys, veins, genitals	Head	In the head
Taurus	Neck	Venus: smell, liver, flesh	Neck/Throat	Until the shoulders
Gemini	Arms/ shoulders	Mercury: smell, liver, flesh	Arms/shoulders	Until the hands
Cancer	Breast	Moon: stomach/ womb	Chest	Until the heart or stomach (?) (unclear)
Leo	Sides/shoulder blades	Sun: Heart/ brain/sinews	Sides/Heart/ribs	Heart or stomach (?) (unclear)
Virgo	Groin/entrails	Mercury: speech/ thought/bile/ buttocks	Solar plexus/ buttocks/navel	Until the mouth of the Shulamite (?)
Libra	Loins	Venus: smell, liver, flesh	Loins	The kidneys (?)
Scorpio	Genitals	Mars: left ear, kidneys, veins, genitals	Genitals	Until the thighs
Sagittarius	Thighs	Jupiter: touch, lungs, arteries, semen	Thighs	Until the knees
Capricorn	Knees	Saturn: right ear, bladder, phlegm, bones	Knees	Knees
Aquarius	Calves	Saturn: right ear, bladder, phlegm, bones	Calves	In the calves
Pisces	Feet	Jupiter: touch, lungs, arteries, semen	Feet	Until in the feet

illuminated zodiac man manuscripts, nor melothesia texts attached to the few other known contemporaneous Hebrew selenodromia (listed in n. 23).

6.5 Summary and Conclusion

The significance of the study of 4Q318 with Opp. 688, fol. 162v together will now be evaluated. In both composite texts, a very similar zodiac calendar is required to be used together with a secondary text, respectively a brontologion and a melothesia text. Based on the amount of substantial errors in Opp 688 'Zodiac Man,' one may reason that the scribe was probably familiar with the zodiac calendar but unfamiliar with the system of melothesia. It is not known whether the manuscript would have been intended for practical use. If so, the precision required to ascertain the position of the moon in the zodiac would have been lacking because there are no degrees of zodiac signs. In addition, Opp. 688 'Zodiac Man' is replete with errors, even taking into account unique variants. The manuscript could have been prepared to record the method only, since the practice of melothesia and phlebotomy using almanacs is attested in many European manuscripts, and the contemporaneous illustrated Hebrew 'Zodiac Man.'

A major point of interest in Opp. 688 'Zodiac Calendar' is its similarity with *4QZodiac Calendar*. It was shown that Opp. 688 'Zodiac Calendar' could be used with the lunar zodiacal data in the horoscopes in Rochberg's compilation, *Babylonian Horoscopes,* if degrees of the zodiac signs were included. There are no degrees of the zodiac signs in either 4Q318 or Opp.688, in contrast to the hypothetical 'Dodekatemoria scheme.' The lack of degrees in *4QZodiac Calendar* and Opp. 688 'Zodiac Calendar' means that it would be possible for its user to misread the correct sign of the zodiac occupied by the moon on some dates unless they applied some form of calibration. The similarities between the texts are striking, in addition the hypothetical 'Dodekatemoria scheme' and the medieval Opp.688 'Zodiac Calendar,' have an astronomically correlative relationship by both beginning with the moon in Aries.

The Hebrew manuscript MS. Opp. 688, fol 162v is dated to soon after the end of the Byzantine era, a little later and contemporary with the tradition of the Byzantine Greek selenodromia and brontologia. There may have been some cultural borrowing in one direction or another but that is not an entirely satisfactory solution, as unlike the Byzantine zodiac calendars and brontologia the Hebrew manuscript does not have an accompanying archaic-style omen text. An alternative explanation to be considered could be that MS. Opp, 688

'Zodiac Calendar' may represent evidence of transmission from Hebrew, or Aramaic sources from an earlier time reflecting a cross-cultural Renaissance movement. If so, the amalgamation of a zodiac calendar and the physiological component brings together two completely different texts from the same tradition—astrology—but from separate origins. A word should be said that in the Hebrew medieval medical text, the function of the zodiac calendar is not concerned with making predictions about the future, unlike a possible interpretation of 4Q318 and its Byzantine parallels.

If the Hebrew medieval text were linked to an earlier period, it may be relevant to the reappearance of hitherto unknown material found in the Cairo Genizah that was later discovered in the Dead Sea Scrolls. These were: the Damascus Document; the Hebrew version of *Ben Sira*; the *Aramaic Levi Document* and Hebrew fragments of the *Book of Tobit*. The method of transmission in these cases is not known.[62] With regards to the *Damascus Document, Ben Sira* and the *Aramic Levi Document*, Reif comments:

> The textual overlaps between Qumran and G fragment [Genizah] appear to point to some form of continuous transmission.[63]

The issue of the copying and transmission of ancient texts is a subject of ongoing scholarly research. The Genizah is but one source of Judaica and there may be similar reasons why other material attested in the Dead Sea Scrolls should have found their way to other centres of Jewish scholarly life. These may have included Byzantium, where there was an interest in astronomy and medicine, and where different traditions in these fields were being preserved.[64]

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62 C. Hempel, *The Damascus Texts* (Sheffield: Sheffield Academic Press, 2000), 15–18; S.C. Reif, "The Damascus Document from the Cairo Genizah: Its Discovery, Early Study and Historical Significance," in *The Damascus Document: A Centennial of Discovery* (ed. J.M. Baumgarten et al.; STDJ 34; Leiden: Brill, 2000), 109–131; S.C. Reif, "The Discovery of the Cambridge Genizah fragments of Ben Sira: Scholars and Texts," in *The Book of Ben Sira in Modern Research* (ed. C. Beentjes; Berlin: de Gruyter, 1997), 1–22; S.C. Reif, "Reviewing the Links between the Dead Sea Scrolls and the Cairo Genizah," in the *Oxford Handbook of the Dead Scrolls*, 699–672.

63 Reif, "Reviewing the Links," 671.

64 Goldstein, The Medieval Hebrew Tradition in Astronomy," 145.

Summary and Conclusions

> . . . the ra]ven went out and went forth and returned to make known to the l[ast] generations
>
> 4Q254a frag 3 line 4[1]

This research has centred on the proposition that the Aramaic calendars in the Dead Sea Scrolls, *4QZodiac Calendar* and *4QBrontologion* (4Q318), and *4QAstronomical Enoch*$^{a-b}$ (4Q208–4Q209) in the Aramaic Astronomical Book from Qumran are both useable zodiac calendars, and are 'designs for eternity.' It was shown that *4QZodiac Calendar* is a close ancestor of the Hebrew calendar used today and that there are late medieval Hebrew manuscripts containing zodiac calendars which are almost identical in content to *4QZodiac Calendar*, or its late Babylonian sources.

The intellectual link between 4Q318, the only known text of its precise type in antiquity, and virtually identical, popular Byzantine texts was explored, as were hitherto unresearched Hellenistic elements in 4Q208–4Q209. Conclusions about the highly complex issue of cultural transmission with respect to these texts have been left open, since to quote David Pingree who studied the astronomical aspects of 4Q318, "any suggestions are purely speculative."[2] That situation remains the case today, although it is hoped that this study has made a contribution towards future insights.

I also examined Mesopotamian zodiacal and omen texts, including Babylonian horoscopes, a late hypothetical Babylonian zodiac calendar, different kinds of analogous Byzantine texts, a wide range of related Greco-Roman and Ptolemaic zodiac calendars and astronomical instruments, as well as Hellenistic scientific literature, the relevant writings of Philo and Josephus and other texts in the Dead Sea Scrolls in Aramaic and Hebrew, that I thought had a bearing on 4Q318 and the Aramaic Astronomical Book.

As a result of my investigation I propose that 4Q318 and 4Q208-4Q209 are probably 'angelic' books within the tradition of the Aramaic Books of Enoch, and that they form part of the narrative of the skills of the angels who descended to earth and taught human women the 360-day zodiac calendars, how to practise divination with astronomy and meteorology, among other secret forms of divination and magic.

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1 G.J. Brooke, "254a. 4QCommentary on Genesis D," in *Qumran Cave 4:17, Parabiblical Texts, Part 3* (DJD 22; Oxford: Clarendon, 1996), 35–36, Pl. 16. (Translation slightly adapted.)

2 Pingree, DJD 36, 272.

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Supported by Milik's suggestion that 4Q201 may have been a school-exercise copied from a master's dictation, it is suggested that knowledge of the Aramaic zodiac calendars may have been taught to students in the guise of unauthorised wisdom in the angelic narratives. In addition and conversely, the human role model of learning the zodiac calendars may have also been transmitted in the myth of the patriarch Enoch, who was divinely chosen to receive knowledge of astronomy and the calendar. This legend, which also exists in the Ethiopic *Book of Jubilees* and is attested in Hebrew fragments at Qumran, may have been utilised as a pedagogical vehicle, making what could be experienced as dry and quite challenging scientific information, more engaging and stimulating (§2.4.1).

Furthermore, I suggest that the Aramaic zodiac calendars are contextual points of reference for the study of different liturgical texts from Qumran, sectarian and otherwise. The repeated concern in diverse kinds of Second Temple doxologies for the sun, moon, stars, *mazalot*, the seasonal turning points of the year (the *tequfot*), and the correct time for prayer is likely to be bound up with the zodiac calendar and the sun, moon and stars (§2.4.2). The Hebrew calendars including the Jubilees-Qumran calendar attested in the the priestly courses and elsewhere, and *4QcryptA Lunisolar Calendar* (4Q317), which is related to both 4Q208–4Q209 and the Jubilees-Qumran calendar, have different, if closely associated, interests.

This study proposes that there was a multiplicity of shared calendars, rather than a plurality (that is, each group using only their own separate calendar), that there may have been a variety of common texts for different purposes shared by various groups in Second Temple Judaism over periods of time.

It is apparent that 360-day zodiac calendars are attested within societies where a multiplicity of calendars existed. These include Babylonia (the 360-day and 354-day calendars), Egypt, Greece, the Roman Empire, where there was also calendrical upheaval, and Judea where the Dead Sea Scrolls are also witness to variants of mainly 364-day schematic calendars.

The Babylonian calendar is evident in the late biblical books, therefore, to find it in use at Qumran, albeit in Aramaic and harmonised with the zodiac from late Mesopotamian texts, is hugely interesting and invites further research in this area. At present the consensus theory is that there was a schism between pro-Hasmonean groups, who adopted the Babylonian calendar and a sectarian movement in Second Temple Judaism, who used the Jubilee-Qumran calendar. The hypothesis that there were calendrical differences and that these provoked a falling-out between groups is a question of interpretation of some sources, and not derived from unequivocal historical witnesses, nor the collection of scrolls themselves. The view that the calendar was the cause of a political schism in Second Temple Judaism is hard to sustain given the diversity of

important Hebrew calendrical texts, and the Aramaic zodiacal calendars found in Cave 4.

We do not know if the Byzantine Greek astrological texts that were distantly connected with 4Q318 in content had a sacred purpose. To the contemporary mind, since the seventeenth century Age of Enlightenment, astrology is connected with esotericism as opposed to empiricism[3] and is not countenanced as 'sacred.' Yet the practice of physiognomic astrology and zodiacal brontology is attested in the Dead Sea Scrolls, in a collection of sacred, Jewish texts. Part of the purpose of this investigation has been to make the case that these zodiac calendars should lead us to re-evaluate historical ideas, perceptions, values and religious philosophy concerning the 'sacred.'

This study has noted that Philo and Josephus were familiar with the zodiac calendar and that they used the schemes as cosmological metaphors to exegete biblical pericope (§5.2 and §5.2.1). It may be argued that in their work, at least, there appears to have been no contradiction with the idea that the zodiac calendars connected the realm of the divine with humankind. Similarly, the authority conferred on astrology by Abram, as witnessed in several ancient secondary sources, Jewish and non-Jewish, is related to the idea that the heavenly bodies "perform not by their own authority but in accordance with the power of their commander, on whom alone it is proper to confer honor and gratitude."[4] (§2.4.2: *Abram's practice of weather astrology*)

Due to the breadth of this enquiry, I shall give a summary of the main findings for the different manuscripts studied.

The Qumran Zodiac Calendar and Brontologion

4QZodiac Calendar comprises a 360-day, 'ideal' calendar that may be used to calibrate the position of the moon in the zodiac for use with the brontologion. It is also useable with the rabbinical Hebrew calendar and is related to the Babylonian calendar. This was demonstrated by comparing the 4Q318 zodiac calendar with the calendar used in Babylonian horoscopes. In aligning the data with those in Babylonian horoscopes, I demonstrated how the basic scheme might have been used to calibrate actual luni-solar dates. There is not sufficient information, however, to explicate precisely how it was intercalated in terms of the luni-solar cycle, that is, the exact sequence of intercalary years.

3 A. Geneva, *Astrology and the Seventeenth Century Mind: William Lilly and the Language of the Stars* (Manchester: Manchester University Press, 1995), 282.

4 Josephus, *Ant.* 1.156 (*Judean Antiquities 1–4*, Translation and commentary, L.H. Feldman, ed. S. Mason), 57.

It is possible that an intercalary Ellul was in place because this practice is attested in the Jewish calendar in the fourth century C.E.[5]

I have reviewed the consensus position in the critical edition that 4Q318 is related to MUL.APIN in favour of findings from more recent research by Lis Brack-Bernsen and John Steele. They put forward a hypothetical ideal 360-day zodiacal model, the 'Dodekatemoria scheme,' based on elements of late Babylonian calendar texts. It is clear that *4QZodiac Calendar* is technically closer to this scheme than to the 364-day Jubilees-Qumran calendar traditions.

Some of the main points of interest are that the names of the signs of the zodiac at Qumran are the earliest attested in Aramaic. I have suggested that the variant zodiac sign names in *4QZodiac Calendar* that are not direct translations of their Babylonian or Greek equivalents could be of Judean origin. The text is not instrinsically Judean aside from the variant zodiac signs of Capricorn (the Kid) and Aquarius (the Bucket). This suggests that it is likely that the zodiac sign names were adopted and revised for use in Second Temple Judaism. A number of the zodiac sign names may have been transmitted from Hellenistic sources and this could place the *Vorlage* of 4Q318 in the early first century C.E. However, if the zodiac sign names stemmed from Hellenistic Mesopotamia the original Qumran zodiac could be up to 200 years older.

Based on the names of the signs of the zodiac in *4QZodiac Calendar*, it may be argued that 4Q318 was a Jewish text with its roots in Mesopotamia, not a contemporaneous Greek composition. The process of transmission in antiquity between late Babylonian texts, Mesopotamian-Hellenistic science and 4Q318 is still unknown. Since the zodiac was a Babylonian innovation, the luni-solar and solar Ptolemaic zodiacal calendars (§5.4 and §5.4.1) would have originally descended from late Mesopotamian material. Just as the zodiac sign names in 4Q318 took on a biblically acceptable hue in order to conform to the religious environment in Second Temple Judaism, so the zodiac calendars from Egypt adapted the lunar zodiac calendars from Babylonia to their own solar-orientated culture.

The generic zodiac calendar may have had different uses in antiquity, and thunder divination may have been one of these. As with the *4QZodiac Calendar*, the direction of cultural dissemination between Judea, the Hellenistic world and Mesopotamia with regards to *4QBrontologion* at the turn of the era remains unclear. It was found that *4QBrontologion* was descended from different archaic Mesopotamian texts to that of *4QZodiac Calendar* with identifiable Babylonian references removed. The Qumran thunder omen text had been modernised for use by creating the adapted protasis of the position of

5 Wacholder and Weisberg, "Visibility of the New Moon in Cuneiform and Rabbinic Sources," 237–238.

the moon in a zodiac with Judaised sign-names combined with thunder while retaining the ancient apodoses of Babylonian omen tablets.

I drew attention to the scribal exercise in the cuneiform text, K90: this was the only primary source from Mesopotamia that this investigation found that was structurally similar to the combined 4Q318 text. Nonetheless, its astronomical table was non-zodiacal and the omen text did not pertain to thunder. The identification of Greek-Hellenistic influences on *4QBrontologion* was also limited. There is a possibility that the earliest date that the extract of the original Augustan text, the 'Oxford brontologion,' was appended to its astronomical parapegma was 14 C.E.–15 C.E., but the *terminus ad quem* is the late medieval period when it was copied as a combined text (§2.2.4).

One of the formulas in *4QBrontologion*, that of when the moon is in Taurus it affects the Arabs, is reflected in the astrological geography in Manilius's *Astronomica* (early first century C.E.). This would indicate a possible transmission process and interaction with the Greco-Roman world. However, the direction of the flow of Aramaic and Latin and Greek scholarship was two-way. 4Q318 from Qumran is presently the only attested ancestor of the cognate Greek Byzantine astrological texts, not a source from Mesopotamia, where this genre of dual text is virtually unknown. Yet there is also a missing connection between Second Temple Judaism and Byzantium insofar as this combined text is concerned: there are no signs of Hellenistic-Greek versions of 4Q318, although the Byzantine variants and near replicas are well-known. I suggested possible oral transmission through non-western semitic channels (§2.1.3–§2.2.4).

This study argues that 4Q318 is not an outsider text at Qumran. There is an apparent working connection with the synchronistic calendar of the Aramaic Astronomical Book, 4Q208–4Q209, and a possible interconnection with the non-zodiacal annalistic text *4QHistorical Text D* (4Q332), which seems to employ the Babylonian calendar, or a perhaps version of it. In terms of its astrological theme there is an affinity between 4Q318 and parts of the angelic roster of the Enochic Book of Watchers (4Q201–4Q204), the astrological text *4QZodiacal Physiognomy* (4Q186), and a wide variety of liturgical and narrative texts in the Dead Sea Scrolls. There is no reason why it should be regarded as anomalous at Qumran.

The Aramaic Astronomical Book

I have suggested that confusion exists in Qumran studies with regard to the extent of calendrical diversity in the Dead Sea Scrolls. I argue that part of this confusion lies with Milik's analysis of the Aramaic Astronomical Book which

he identified as containing a 'synchronistic calendar' comprising a lunar year of 354 days and a fixed 364-day year that had a triennial cycle, the Jubilees-Qumran calendar. Milik's hypothesis meant that the Aramaic Astronomical Book was incorrectly categorised with the 364-day calendars found at Qumran and, consequently, 4Q318 has been isolated in the scholarship of the Dead Sea Scrolls (§Introduction).

This study has revised Milik's model by reviving the theory that the 'gates' represent zodiac signs and proposing a probable solar year of 360 days, rather than 364 days, that is harmonised with the lunar year of 354 days. Nonetheless, Milik's work was ground-breaking and it should have been explicitly included in the field of Qumran calendar studies, a subject area whose scope still needs to be widened to definitively include the two Aramaic calendars, *4QZodiac Calendar* and the now-revised synchronistic calendar.

The Aramaic synchronistic calendar and calendrically-related scrolls, *4QAstronomical Enoch*$^{a-b,d}$ (4Q208–4Q209, 4Q211) have been the subject of this investigation insofar as the components of these scrolls may be directly relevant to *4QZodiac Calendar*. While it is true that no zodiac signs are mentioned in 4Q208–4Q211, there had been a long scholarly conversation as to whether the heavenly gates where they appear in the Ethiopic *Book of Luminaries* (*1 En.* 72–82) represented zodiac signs.

Otto Neugebauer's thesis that the 'gates' in *1 En.* 72–82 did not symbolise the zodiac signs has been the consensus view on this matter for almost half a century. Prior to Neugebauer's assertion that the 'gate' numbers represented the points of arc on the horizon where the sun and moon rose and set, scholars in the nineteenth century, following Richard Laurence's interpretation, held the view that these numbered symbols represented the zodiac signs. This research has demonstrated that the 'gates' in the Ethiopic *Book of Luminaries* schematically correspond to the sun and moon's entry into the zodiac signs, thereby supporting the work of Laurence. Furthermore, it has been shown that the same typology can be applied to the references to the 'gates' in the Aramaic texts 4Q208–4Q211 in the Qumran Astronomical Book.

Neugebauer did not demonstrate that the 'gates' as zones on the horizon could possibly have served the moon, which would have been astronomically inaccurate. That the different points on the horizon where the sun rises and sets in the seasons coincide with the zodiac signs is evident from the plethora of Greco-Roman zodical sundials (§4.4.2 and §4.4.3) and zodiacal solar astronomical instruments. The zodiacal arrangement on the Greek-Hellenistic zodiac sundials suggests that Greco-Roman science had influenced Jewish scholarship in the synchronistic calendar of the Aramaic Astronomical Book in the Dead Sea Scrolls. This arrangement of zodiac signs, placed in relation to the solstices, is not evidenced in Mesopotamian archaeology.

The intersection with the zodiac sundials and astronomical instruments from Greece and Rome and the synchronistic calendar of 4Q208–4Q209 further illustrates that the scientific world of the Mediterranean and Mesopotamia in the first and second century B.C.E. and the first and second century C.E. was highly interactive, facilitating cross-cultural interest in the zodiac. I also pointed out that the alternating months of 29 and 30 days evident in the synchronistic calendar of 4Q208–4Q209 is found in Greek calendars, not in Babylonian calendars. The implication is that the synchronistic calendar in the Qumran Astronomical Book contains strong Greek elements.

Late Medieval Hebrew Zodiac Calendars

Presently, our knowledge of the process by which an ancient Semitic zodiac calendar appeared in Qumran in Aramaic and many centuries later in Hebrew in Byzantium and Europe, is still opaque. This research examained and published the zodiac calendar and astrological section of a fifteenth century Hebrew manuscript from the Bodleian Library, University of Oxford, MS. Opp. 688 fol. 162, which is similar in construction and content to 4Q318. It also examined an identical Hebrew zodiac calendar to that in Bodleian, the fifteenth century Hamburg Miscellany fol. 121r, housed in the Hamburg State and University Library (§6.2.3 n. 23). The Bodleian zodiac calendar and the Hamburg version followed the mathematical pattern of the late Babylonian zodiac calendar texts.

In the Bodleian manuscript the copyist had amalgamated the zodiac calendar with another astrological tradition: at the bottom of the zodiac calendar is a section where human body parts are assigned to zodiac signs. This is an astrological system known as melothesia that was popular in the medieval period. The zodiacal calendar would have been used for phlebotomy, blood letting to balance the humours according to Classical medicine. The combination of an almanac stating the daily zodiacal position of the moon was traditionally used to ensure that the body part 'ruled' by a particular zodiac sign was not surgically bled when the moon was in that sign.

Similarly, the reading of the prognostication for thunder in *4QBrontologion* is dependent on its zodiac calendar for the correct forecast to be selected. It may be argued that MS. Opp. 688, fol. 162, is another example of a composite astrological text in which different zodiacal traditions, originally separated in time and place, have been brought together.

The discovery of the Hebrew manuscripts of *Ben Sira* later known from Masada, the *Damascus Document*, the mainly Aramaic fragments of *Tobit*, and the *Aramaic Levi Document* in the Dead Sea Scrolls and in the Cairo Genizah,

showed that texts from Second Temple Judaism had an as-yet unknown Jewish transmission history spanning several centuries.[6] The similarity between the late Hebrew medieval zodiac calendars and the Aramaic zodiac calendar from Qumran may suggest a common origin and unexplored modes of dissemination though Jewish communities in the diaspora. Alternatively, the fifteenth century Hebrew zodiac calendars in the esoteric handbook, Opp. 688, in the Bodleian Library, and in the Hamburg Miscellany that are related to *4QZodiac Calendar* may have been rediscovered in the cosmopolitan world of Byzantium and were reabsorbed into learned Jewish circles. Some Greek Byzantine versions of the zodiac calendars with their brontologia predate the known late medieval Hebrew zodiac calendars, so it seems unlikely that these texts were adopted by diaspora Jews through some coincidental cultural borrowing *ab initio*.

Recommendations for Further Study

The subject of zodiac calendars could be developed into a distinct field within calendar scholarship. Future research could include the tracking of zodiac calendars with and without linked omen texts and other divinatory material in the medieval period in languages other than Greek. There are hundreds of other unpublished astrological and divinatory materials in Jewish manuscript collections in libraries, many of them uncatalogued.[7] The question also remains open of whether *4QZodiac Calendar* fits into the history of

6 See S.C. Reif, "Reviewing the Links Between the Dead Sea Scrolls and the Cairo Genizah," in *The Oxford Handbook of the Dead Sea Scrolls* (ed. T.H. Lim and J.J. Collins; Oxford: Oxford University Press, 2010), 652–679. Reif states that earlier Jewish material was found in other archives around Cairo (at 653). Idem, "The Genizah and the Dead Sea Scrolls: How Important and Direct is the Connection?" in *The Dead Sea Scrolls in Context: Integrating the Dead Sea Scrolls in the Study of Ancient texts, Languages and Cultures* (ed. A. Lange, et al.; SVT 140; Leiden: Brill, 2011), 673–692.

7 G. Bohak, "Towards a Catalogue of the Magical, Astrological, Divinatory, and Alchemical Fragments from the Cambridge Genizah Collections," in "*From a Sacred Source*" (ed. B.M. Outhwaite and S. Bhayro; Leiden: Brill, 2010), 53–80. He classified 349 mss as astrological, including 5 brontologia and 6 horoscopes (Appendix A, p. 74); S. Reif, *Hebrew Manuscripts at Cambridge University Library: A Description and Introduction* (Cambridge: Cambridge University Press, 1977), catalogues many astrological and astronomical texts; B.R. Goldstein, "The Hebrew Astronomical Tradition: New Sources," *Isis* 72.2 (1981): 237–251; B.R. Goldstein, "The Hebrew Astrolabe in the Adler Planetarium," *JNES* 35.4 (1976): 251–260.

late antique Palestinian synagogue zodiacs,[8] and if it does, how this interaction was achieved.

There is also room for further research on the zodiac calendar in medieval Christian liturgical texts prior to the introduction of the Gregorian calendar in 1582 by Pope Gregory XIII, which was only very slowly adopted throughout the non-Roman Catholic world.[9] Although the Gregorian calendar is a revision of the Julian calendar mathematically it erased the zodiacal layers of the 'pagan' Roman calendar culturally.[10]

One of the most important findings of this investigation was that *4QZodiac Calendar* and the medieval Hebrew zodiac calendars could be used with the Hebrew calendar today, as well as with the Babylonian calendar. There was also reason to believe that 4Q208–4Q209 is useable with the Babylonian and the Hebrew calendar as well. The conclusion is that the Jewish calendar today is a close descendant of the Babylonian calendar, and that, almost certainly it can be traced back to the Dead Sea Scrolls for its Jewish context.

This detective story brings together, for the first time, the Qumran zodiac calendar and brontologion, the Aramaic Book of Astronomy, poetry, calendars, literature and mythology in the Dead Sea Scrolls and Second Temple literature; the zodiacal calendar and astronomical omen scholarship from Mesopotamia, Babylonian horoscopes, Ptolemaic zodiacal science, Greco-Roman sundials, Philo and Josephus and Greco-Roman authors, the Byzantine astrological texts that are similar to 4Q318, and a previously unpublished late medieval Hebrew zodiac calendar with a related astrological medical text, and the rabbinical Hebrew calendar used today.

It became evident from the start of this research that the spectrum of zodiac calendars attested throughout the Mediterranean and ancient Near East comprise an under-studied field of scholarship. The absence of a delineated

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8 Hachili, *Ancient Mosaic Pavements*, 54–56, 230; Hachili, "The Zodiac in Ancient Jewish Art," 74; Hachili, *Ancient Jewish Art and Archaeology in the Land of Israel*, 309; J. Magness, "Helios and the Zodiac Cycle in Ancient Palestinian Synagogues," 373–376; Fine, *Art and Judaism in the Greco-Roman World*, 196–205; S. Schwartz, *Imperalism and Society*, 172–173.

9 Richards, *Mapping Time*, 239–256; Blackburn and Holford-Strevens, *The Oxford Companion to the Year*, 683–688.

10 I am deeply indebted to Jane Ridder-Patrick for so generously sharing with me the Revd R. Pont's tables in the preface of the Geneva Bible that was first published in Scotland in 1576 and 1579. The rules contain Hebrew and Roman calendar conversion tables with notable dates, and a zodiac calendar captioned: 'A table to find out in what figne the Moone is at any tyme for ever' (*The Bible and the Holy Scriptures conteined in the olde and newe Testament*, Edinburgh: Bassandyne and Arbuthnet 1579). Scotland adopted the Gregorian calendar in 1600.

theoretical framework within which to place these seemingly disparate zodiacal calendars means that they cannot be fully understood within their specific contemporary and cultural contexts. A theoretical framework for zodiac calendar traditions could be developed to encompass the interdisciplinary nature of this subject that can also work within culturally specific contexts.

The zodiac calendar scheme has endured and has been preserved in popular as well as esoteric science, the arts and medicine for more than 2,000 years. With the benefit of a newly formed zodiac calendar matrix that is integrated into the history and the use of the zodiac in its many forms, it may be possible to understand the zodiac calendars including the Jewish calendar, each within their separate, albeit connected cultural contexts, as well as in relation to one and other.

The study of *4QZodiac Calendar* and *4QBrontologion* and the Aramaic Astronomical Book as related texts in the Dead Sea Scrolls will, it is hoped, lead to a greater balance with regards to future scholarship in this fascinating field, giving due weight to the serendipidous nature of the discoveries. It is hoped that these findings will further enrich and deepen our understanding of the intellectual world of Second Temple Judaism, the background of the sacred texts at Qumran, and the survival of their 'angelic' mathematics.

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